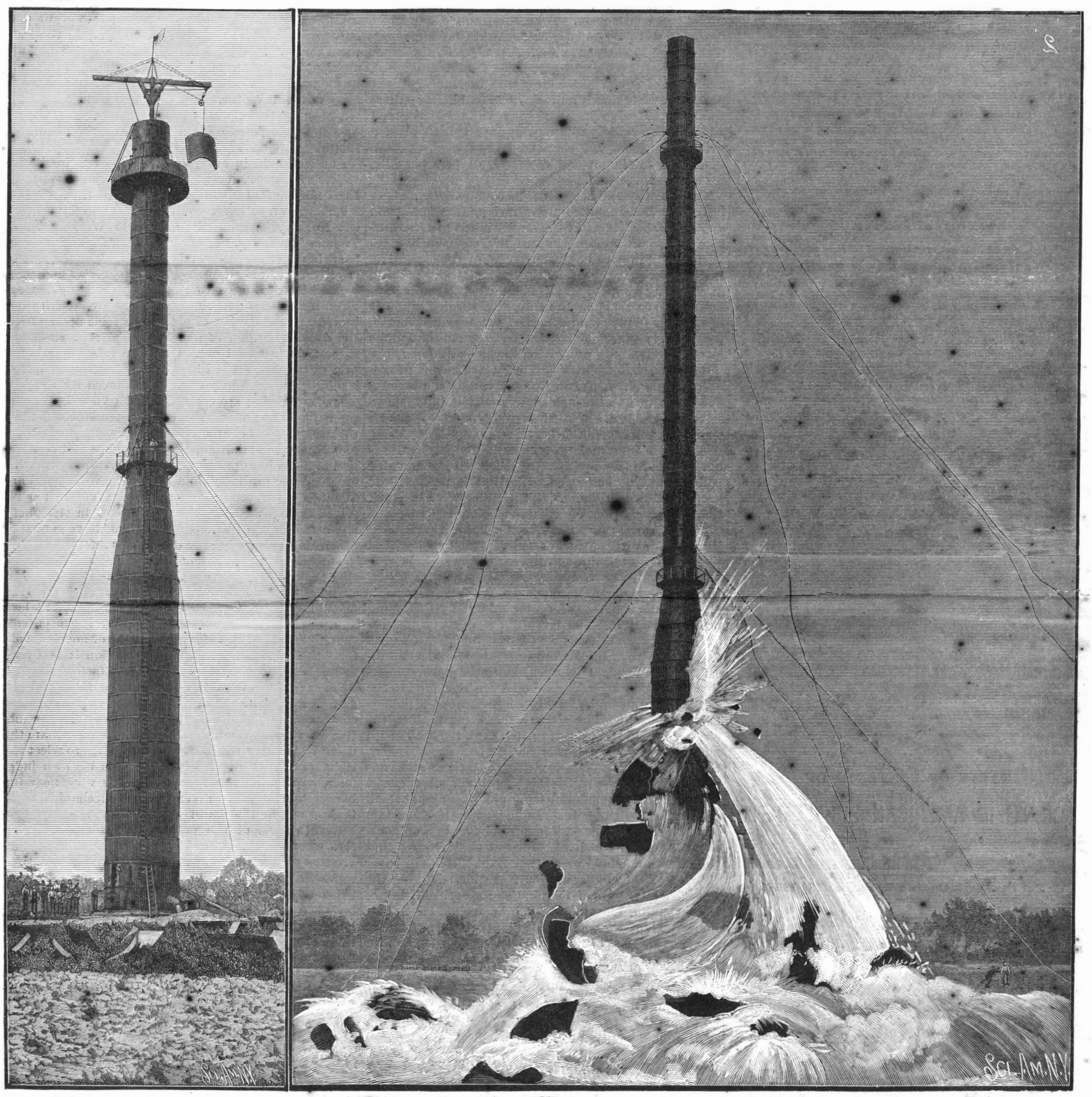
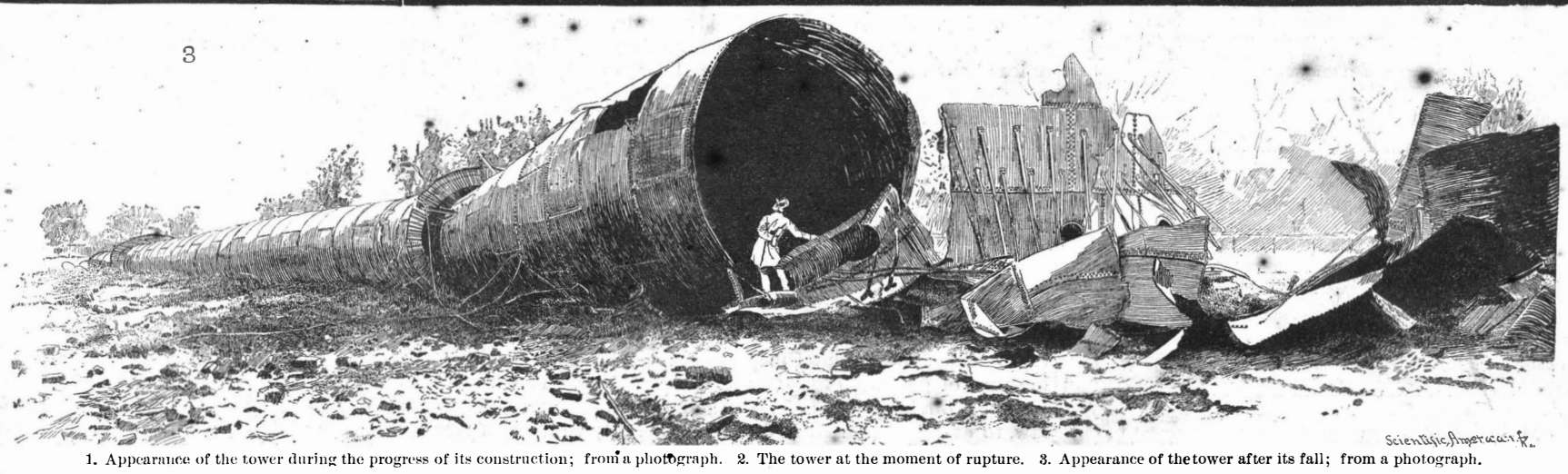
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LV.—No. 26. [NEW SERIES.] NEW YORK, DECEMBER 25, 1886. [Price 10 Cents. $3.00 per Year.

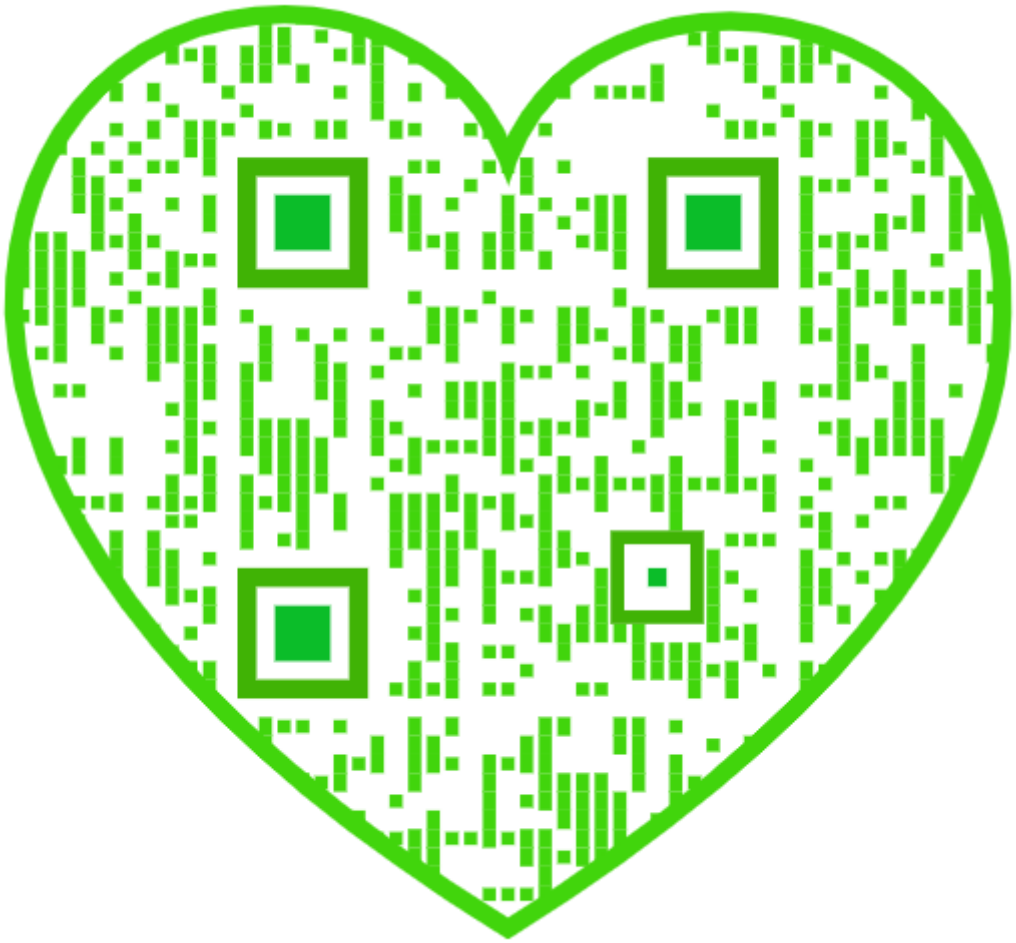




1. Appearance of the tower during the progress of its construction; from a photograph. 2. The tower at the moment of rupture. 3. Appearance of the tower after its fall; from a photograph.

RUPTURE AND FALL OF THE 250 FOOT STEEL PLATE WATER TOWER AT SHEEPSHEAD BAY, N. Y. [See page 405.]

© 1886 SCIENTIFIC AMERICAN, INC



Scientific American,

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.....$3 00
One copy, six months, postage included..... 1 50

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.00 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal or express money order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, DECEMBER 25, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Atmosphere of caves..... 401
Barometer, glycerine, Mill's*..... 403
Books and publications, new..... 408
Bubbles, mercury*..... 404
Business and personal..... 408
Car coupling, Locke's*..... 402
Cottor chopper, Puls'*..... 404
Cow, sea*..... 407
Dividend every week..... 404
Equality..... 407
Frog, fishing, the*..... 407
Firearms, lock for, improved..... 405
Guns, Gatling, types of recent*..... 406
Gun, Gatling, mounted on tripod*..... 406
Gun, ten barreled*..... 406
Harrow, improved, Carstensen's*..... 402
Harrow, improved, Owen's*..... 402
Hoadley, John C..... 405
Hook and buckle, combined*..... 404
Inventions, agricultural..... 408
Inventions, engineering..... 408
Inventions, index of..... 409
Inventions, mechanical..... 408
Inventions, miscellaneous..... 408
Investment, a sure..... 404
Inventor, doubt must be resolved in favor of..... 401
Manatee, or sea cow*..... 407
Mercury bubbles, blowing*..... 404
Mercury film*..... 404
Mercury foam*..... 404
Notes and queries..... 408, 409
Potatoes, large, how to grow..... 405
Rule, good, a..... 400
Scribner's Magazine for Jan., 1887..... 406
Snow from streets, removal of..... 400
Soap, textile..... 402
Steam as motive power of aerostats, direct use of..... 401
Steamers, ocean, propulsion for, by the steam jet..... 401
Sugar evaporating pan improved*..... 403
Telephone transmitter, Sargent's*..... 403
Tower, water, great, fall of*..... 399, 405
Trichechus Americanus manatee*..... 407
Tunnel, Severn, opening of, to passenger traffic..... 406
Water tower at Sheepshead Bay, N. Y., fall of*..... 399

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 578.

For the Week Ending December 25, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—Nebulæ and Planets.—By H. GOUPIL.—The nebular hypothesis of the formation of planetary bodies; the action of nebular masses under rotary and central forces; formation of rings; Saturn's rings.—14 illustrations..... 9153

II. ELECTRICITY.—Buckmill's Contact Breaker.—A simple and practical apparatus, depending for its action on the action of an electric ring with points mounted within it.—1 illustration..... 9151

III. ENGINEERING.—Benier's Hot Air Engine.—A new hot air engine designed to avoid the difficulties hitherto attendant upon the lubrication of this class of machinery.—6 illustrations..... 9143

Friction.—By Prof. H. S. HELE-SHAW.—The second installment of this lecture; one of the most exhaustive treatments of the subject yet given.—19 illustrations..... 9148

On the Design of Slide Valves.—By Prof. R. H. SMITH.—A simple and practical method for determining the lap of slide valves, including examples of calculations, and giving a diagram for the graphic and mathematical calculation of the factors.—1 illustration..... 9144

On the Remarkable Effects of Adding Saccharine Matters to Mortars.—By SAMUEL CROMPTON.—A full review of this recently revived process of mortar making; the valuable features of the addition of sugar to mortar; an eminently practical treatment of the subject..... 9145

The Hudson's Bay Railway.—The new railroad now in course of construction to connect the Canadian Pacific R. R. with Port Nelson on the west shore of Hudson's Bay.—Map of the route and connections.—1 illustration..... 9144

IV. METEOROLOGY.—Thunderstorms.—The relation of barometric movements to thunderstorms.—The results of observations taken during the phenomenally frequent thunderstorms of July, 1884, in Germany.—A communication to the Berlin Physical Society by Prof. BORNSTEIN..... 9154

V. MINING ENGINEERING.—Hand Stamp Mill.—Description of a small three-head stamp mill for prospectors's use in crushing samples of quartz.—1 illustration..... 9147

The History of Californian Borax.—By ARTHUR ROBOTTOM.—A full account of this important industry of California.—Economic details, analysis of product, and uses of same..... 9147

VI. PHOTOGRAPHY.—Improved Dark Room Lamp.—By F. C. BEACH.—A gas lamp for use in developing plates in the dark room, in which ventilation and the avoidance of heat are both provided for.—In use in the room of the Society of Amateur Photographers.—4 illustrations..... 9146

VII. TAXIDERMY.—The Mounting of an Elephant.—Full description of the mounting of the skin of the elephant Mungo.—A very remarkable triumph of the taxidermist's art.—The death of Jumbo and mounting of his skeleton and skin.—5 illustrations..... 9151

Index for SCIENTIFIC AMERICAN SUPPLEMENT, Volume XXII.

REMOVAL OF SNOW FROM STREETS.

The difficulty of cleaning the streets not only is perennial, but it is one that becomes more disagreeable, and yet more imperative, with the increase of traffic and the growth of population. The streets of New York are frequently choked by the throngs of vehicles even in the best of weather, and of course a heavy fall of snow makes matters worse. In addition to the trouble thus caused, the accumulations of snow are sources of annoyance to pedestrians, and the filth collected in the slushy mass is a serious danger to health.

The expense of carting away the snow has been variously estimated to range from seventy-five cents to one dollar per cartload; but even at fifty cents per cartload it is manifest that to properly clear the streets would cost enormously. Take, for example, one street block 200 feet long and say 50 feet wide, having a surface area of 10,000 square feet. A moderate snowfall of three inches of snow will give 2,500 cubic feet on that one block of street. Assuming that in loading this is packed down to nearly half—say 1,350 cubic feet—there would be 50 cubic yards of snow to be carted; and allowing two cubic yards as the outside limit of each load, there would be 25 cartloads to be taken from each block, at a minimum cost of $12.50, or $250 per mile, for every snow storm.

The use of steam has often been suggested, and we have described in our columns various forms of steam apparatus, but they have generally failed to give satisfaction, in part because they are not sufficiently expeditious, and in part because they were too expensive. In New York, Lockport, and other cities where steam distributing companies have laid mains, attempts have been made to melt off the snow by turning upon it live steam. This plan melts the snow very fast, but in nearly every experiment there has been an enormous loss of free steam in proportion to the work done.

Recently, Mr. Charles E. Emery, C.E., Chief Engineer of the N. Y. Steam Company, has employed a novel apparatus with such success that it bids fair to solve the problem. While it is probable that it can be operated more expeditiously and economically by using steam taken from underground supply pipes, its use is not limited to this supply. Any locomotive or movable boiler could be employed. All that is needed is to keep the steam in contact with the snow without letting a great portion of it escape before touching the snow. For this purpose a broad, light, rough, and strong sled, with openwork runners, is fitted with a short pipe passing through the top of the sled, having a hose coupling at its upper end. A tarpaulin, or canvas spread, about 25 feet square, made steam tight, extends from the sled as a center, and the hose coupling passes through it. The tarpaulin is piled on the sled until it is drawn to the place for beginning work; the tarpaulin is then spread out upon the snow to its fullest spread, the edges are tucked into the snow, connection is made by hose from a boiler or steam pipe to the sled, and the steam is turned on, a pressure of 40 pounds being sufficient. The steam cannot escape into the air, but is held right down to the work required of it; and in a very few minutes the deepest snowbank or the iciest packed roadbed yields to the heat and runs off as water. By repeating this operation a street can be cleaned in a very moderate length of time and at small expense. The three inches of snow on 10,000 square feet of street on a block, if removed by carts, would be, say, $12.50. The melting process would require that the tarpaulin should be shifted sixteen times to cover the street 200 feet long and 50 feet wide. Making the excessive allowance of 15 minutes for each shifting of the tarpaulin, the street would be melted off in four hours. The cost would depend upon the amount of steam used. That is a difficult matter to calculate, for it would vary according to the temperature of the air and of the snow. The N. Y. Steam Co. charges $1 for 2,000 pounds of steam, which would melt from six to seven tons of snow, and on that basis the steam would cost from three to four dollars per block, and the labor of attendants, etc., probably as much more, say $8 per block, or $160 per mile.

To carry out such an undertaking, even where there are steam mains already laid, would call for a considerable outlay. Steam plugs, like fire hydrants, would be needed on every corner, and each melting would require about 100 to 125 feet of steam hose, capable of sustaining a pressure of certainly over 40 pounds to the square inch, and preferably 80. It is probable that a private company could be organized to do this work. The plan has been successfully operated, and it seems to present a practicable and economical escape from the present disagreeable and dangerous condition of our streets during the winter months.

A GOOD RULE—DOUBT MUST BE RESOLVED IN FAVOR OF THE INVENTOR.

The question is sometimes asked why it is that the examiners of the Patent Office are so liberal in the allowance of patents, especially in simple things. The answer is obvious. It is clearly their duty, under the law, to exercise the greatest degree of liberality toward the inventor, and to do everything in their power to facilitate him in securing his invention by patent. The inventor is a man who supplies the country with new and valuable forms of industry; by means of his new inventions he enables the public to save time and money in the performance of labors, and he supplies the people with all manner of comforts and conveniences. In the earlier days of the Patent Office, the examiners did not so fully appreciate their relations to the inventor as at present.

Many of them were in the habit of officially acting against the inventor by finding flaws in his devices, and rejecting if the thing was simple, or if there was doubt of novelty or reality of invention. They used to act upon the idea that their chief duty was to refuse patents. This was all wrong. The constitution expressly provides that the useful arts are to be encouraged by the grant of patents. It is to grant patents that examiners are chiefly employed in the Patent Office. The simple inventions for which patents are asked are the most numerous and the most valuable to the public. If errors are to be made, let them be in favor of the inventor. It is better to grant a hundred erroneous patents, which are worthless, than to refuse a single patent for a new invention, however simple.

Doubt should in every case be resolved in the inventor's favor. A recent trial before Judge Coxe in the U. S. Court, Indiana, well illustrates this.

This was an action in equity based upon letters patent No. 273,023; granted to Orlando W. Butler and Thomas W. Kelley, February 27, 1883, for an improvement in paper for cards and circulars. The purpose of the invention was to supersede the expensive and cumbersome method of pasting separate cards upon wedding invitations and similar papers by substituting therefor a card having two or more folds upon which the desired number of panels to represent cards are embossed or pressed out. On these raised panels the printing may afterward be done. When the invitation is folded, the unsightly cavities produced by the process of embossing are concealed from view by one of the flaps of the paper. The cards when finished have the same general characteristics as their pasted predecessors; but, in addition, they are more symmetrical and uniform in appearance, can be manipulated with greater ease, are less liable to become soiled, and are about fifty per cent cheaper. The invention has received the marked approval of dealers in stationery and of the public. The patented cards have gone into general use, displacing the old devices referred to.

The defenses were lack of novelty and invention, and that the complainants are not joint inventors.

Judge Coxe said the proof demonstrated that the field in which the complainants operated was at best a narrow one, and the question arises, Is the patent, though it cannot be defeated for want of novelty, void for lack of invention? To this question it is by no means easy to give an entirely satisfactory answer. Each case must depend upon its own facts and circumstances. The perplexities which surround such controversies cannot always be solved by an examination of adjudged cases. The serve to illuminate the paths to be traversed; but he who desires to select the right one must depend largely upon his own judgment. Although the present case is very near the border line between invention and mechanical skill, it is thought the doubt which arises should be resolved in favor of the patent. No one ever did before what the complainants did—viz., produce an invitation card with two or more folds having panels, to represent cards, embossed thereon, upon which the printing is afterward done. This particular structure is new, useful, and inexpensive. It soon became popular; it supplies a need. Time and thought were required in its development. The obstacles which therefore could only be surmounted by skilled labor were entirely eliminated. All this required something more than the labor of the mechanic. It amounted to invention.

The whole matter is well illustrated by a question and answer, quoted with approval upon the defendants' brief. One of the complainants was asked if he thought that prior to October, 1880, persons of ordinary skill in the art would have been unable to produce representations of cards by embossing upon paper, and the answer was: "If they happened to think of it; probably they would not." Exactly so. It is the presence of a thought like this which raises an ordinary mechanic to the plane of the inventor. Invention requires thought; mechanical skill does not. The one is the result of mental, the other of manual, action. Grant that the invention is a simple one, that when viewed from our present standpoint it is hard to understand why the idea did not occur to some one long before, and yet the fact remains that it never did, though something of the kind was long wanted.

After giving the subject the best thought of which I am capable, I am convinced that to relegate these complainants to the condition of mere skilled workmen would be to do them a grave injustice. In the light of the present the idea of substituting hard rubber for other material as a plate for holding artificial teeth, or of providing tubular kerosene lanterns with an irreversible current of air by means of deflectors, seems

© 1886 SCIENTIFIC AMERICAN, INC

simple enough, and yet the men who thought of these things conferred lasting benefits upon the world and received the rewards of inventors.

In *Crandall v. Watters* (20 Blatchf., 97) the patent was for a box loop for carriage tops made of thin metal, from which the loop was struck up. It was used as a substitute for the old leather housing. In sustaining the patent the remarks of Judge Blatchford are so applicable to the case at bar that I quote briefly from the opinion. At page 102 he says:

"Various old devices are introduced. . . . But no article like the plaintiff's, capable of being taken and used for the purposes for which the plaintiff's can be used without alteration and adaptation requiring invention, existed before. Almost all inventions at this day that become the subject of patents are the embodiment and adaptation of mechanical appliances that are old. In that consists the invention. When the thing appears, it is new and useful. No one saw it before. No one produced it before.

"It supplies a need; it is at once adopted; all in the trade desire to make and use it; yet it is said to have been perfectly obvious and not to have been patentable. Where an article exists in a given form and applied to a given use, and is taken in substantially the same form and applied to an analogous use, so as to make a case of merely double use, there is no invention; but it is very rarely that a thing of that kind secures a patent."

There should be a decree for the complainants for an injunction and an account, with costs.

THE ATMOSPHERE OF CAVES.

The largest volume of subterranean atmosphere with which we are acquainted is found in Mammoth Cave, Ky. This cave, or rather system of caves, is very extensive, greatly exceeding the other two notable caverns in our country: the Luray of Virginia and the Wyandott of Southern Indiana. The passageways of Mammoth Cave have a combined length of over 150 miles, and their area covers hundreds of acres. It is estimated that the entire volume of atmosphere thus inclosed exceeds twelve million cubic yards. In this underground world the ordinary atmospheric changes are unknown, summer and winter are unknown, and the heat of the sun never reaches its unbroken night.

Like all our larger caverns, the temperature is alike at all times and seasons. In the summer there is a brisk outward current, having a temperature of 53° to 54°. This current is doubtless fed by certain leakages of air which filter through the sinkholes, which discharge their moisture at certain points in the cave system.

In the winter, there is a current of air setting inward. This is not perceived at a distance of one-fourth of a mile from the entrance. It nevertheless depresses the thermometer a few degrees, and its effect upon the humidity of the air is evident at the distance of three-fourths of a mile.

For the first time hygrometric observations have been carefully made as to this unique body of atmosphere. The dryness of the air has often been noticed, and the resultant niter beds were esteemed a matter of national importance during the war of 1812.

In the "Gothic Gallery," several miles underground, visitors have been wont to deposit their cards, and these cards have remained for years, fresh as new, save where moist finger prints have left behind them the germs of mould. The ground is seemingly dusty, but still the dust, if stirred, will not rise in the air, nor soil a polished shoe. In these portions of the cave, which seemed destitute of moisture, the wet and dry bulbs of the hygrometer showed the same figure, the variations seldom exceeding one-fourth to one-half a degree. The humidity ranged between 96 and saturation. With the thermometer at 54°, the wet bulb would range between 53½° and 54°, and the dew point would be between 53$\frac{1}{10}$° and 53$\frac{7}{10}$°. The singular fact was noted that the same temperature prevailed at the roof as upon the floor of the cave; and where differences of 200 to 300 feet of elevation occurred, the thermometer would be depressed one or two degrees at the higher as compared with the lower altitude. The humidity would, however, remain a constant quantity. This can be accounted for only on the supposition that the supply of air, slowly admitted from above, is chilled by the absorption of moisture during the first stages of its descent, and becomes slowly warmed before completing its full descent of 300 feet. Mould is rarely seen in the cave, but wherever it occurs, a snowy whiteness and luxuriance of growth are noted.

One avenue of the cave is devoted, with excellent success, to the growth of mushrooms, and no doubt such an atmosphere might have an industrial value for other purposes.

Several consumptives once tried to live, and get well, in the cave. But the result was disastrous. The lack of light was, no doubt, one reason of this; but the hygrometric condition of the air, of which nothing was then known, by greatly retarding healthy perspiration, doubtless hastened the fatal result.

R. NORTON.

DIRECT USE OF STEAM AS MOTIVE POWER OF AEROSTATS.

M. Duponchel, Chief Engineer of *Ponts et Chaussees*, became convinced that the substitution of hydrogen for heated air as the source of ascensional power, while in some respects a progress, had operated to turn aside the new science of aerostation from its natural channel. He believed that the modest Montgolfier balloon of Pilatre de Rozier, carrying with it its own ascensional organ, was nearer to the solution of the problem than the great captive balloon, fresh in the memory of every one. General Meunier, member of the Institute at the beginning of the century, had fully determined the construction of aerostats designed for the transformation of vertical into horizontal motion. For this end he gives the balloon an envelope of fixed shape, with two separate cavities of variable volume, not communicating with each other; but being so constructed that as one expands under any given conditions, the other contracts in exact proportion.

M. Duponchel thinks that he thus will arrive at the solution of the problem of guiding balloons. The school of mechanical solution having only succeeded in constructing toys, and having reached their limit, the study of bird movements must give place to balloon aerostation. To-day, after the results obtained by MM. Tissandier, Renard, and Krebs, the velocity of aerial currents presents the principal difficulty. Upon the surface or under water, a steam vessel capable of reaching a velocity of 19 feet can be master of its movements in the midst of currents never exceeding one-half that velocity; but the aerostat, in the midst of winds whose ordinary velocity is 30 to 40 feet, and which may be as great as 130 or 160 feet in tempests, must be capable of a higher speed if to be used at all times.

M. Duponchel has concluded that a velocity of 60 to 100 feet, enough for all ordinary conditions, could be obtained with a fish-shaped balloon of 700,000 cubic feet capacity, 282 feet long and 70 feet 6 inches high, half filled with hydrogen, and hence having an ascensional force of 26,460 pounds. For velocities of 30, 60, or 100 feet, 60, 480, and 1,620 horse power will be respectively required. It is perfectly evident that no machinery known to us will be available for the production of such power as this in a balloon. But this enormous motive power, though beyond the scope of our machinery, can be obtained from the direct employment of steam as heating agent in a Montgolfier balloon, following in the footsteps of Pilatre de Rozier. Thus, if we inject into a volume of 35,000 cubic feet of hydrogen, contained in the aerostat just described, a quantity of steam sufficient to raise its temperature 78° Fah., its volume is dilated 22 per cent, giving an extra ascensional force of 3,000 pounds, or the equivalent of 700 horse power for one hour. Two systems are described by M. Duponchel. We shall only speak of the first.

An aerial fish of the Meudon model, but with rigid envelope, is the base. Its interior is divided by a flexible membrane into two parts, the upper containing hydrogen gas, that can be more or less expanded by the injection of steam into the lower chamber. Vertical and horizontal fins are used to determine the movements. By shifting ballast the aerostat is inclined and steam is injected, expanding the hydrogen one-fifth of its volume. This causes it to rise and move forward, owing to its inclination. When the gas is cool, the aerostat is brought again into a horizontal position, or inclined the other way, by further shifting of the ballast, and allowed to descend. When near the ground, the ballast is again shifted and the hydrogen heated, so that by a succession of undulations the movement in advance is obtained.

In the case of a balloon of 700,000 cubic feet capacity, the maximum elevation would be 9,800 feet, and the undulations in a distance of seven miles would be gone over in 33 minutes, thus giving a speed of 13½ miles per hour, nearly, with the expenditure of about 350 pounds of coal. This would necessitate renewal of fuel about every 30 miles.—*Abridged from Revue Scientifique.*

PROPULSION FOR OCEAN STEAMERS BY THE STEAM JET.

Having recently in your columns discussed the practicability of the propulsion of boats by using a jet or current of compressed air as our motive agent, the question very naturally occurs, Must we necessarily in this matter limit ourselves to small motors and small boats? If so, the application is somewhat limited, and we fail to take hold of a thing of really general interest.

The plan which I suggested in that article does actually seem restricted in its extension by its own terms.

It involves a reservoir, which is to be filled before starting, and the energy therein stored gives us our limit, and it must, of course, be narrow. A period of a few hours at the furthest is all that we can command. This of itself is certainly of immense practical value; but we will try to look for something better. We need to keep the open sea; we need a power which we can renew incessantly, as we now generate our steam. Can we do it, and still use, in the manner which I have suggested, direct propulsion?

I belive the thing is practicable, and I will try to show it. We may, of course, make use of compressed air for driving our largest ships precisely in the same way as directed by me for the Whitehall boat. It is merely a question of the size of the jet or jets. One-sixth or one-tenth of a horse power, as with the boat, or 1,000 or 5,000 horse power, as with the ocean steamer, what does it matter? If the smallest will do its work, the largest can be equally trusted for its full efficiency. We can certainly employ compressors by means of which the entire power of the steam generated constantly shall be as constantly employed in keeping up a steady pressure in a suitable reservoir, from which the air jet or jets beneath the ship's bottom are supplied, and by which the ship is driven forward, precisely as was the boat. This is surely possible, and if we can drive the boat, we can drive the ship; but this is by no means the plan which it is my object here to propose.

In the double transfer of energy which has been here mentioned, we encounter loss, and it is a loss that seems to me not necessary and not advisable. It is true, we have counteracting advantages which vastly overbalance in their gain the loss which we shall have made, and were there no other way but this, I should be prepared to advocate it most strenuously. We dispense with such an enormous amount of weight in engine and driving machinery, as well as saving the immense space which they now occupy. Our steamers, freed from the huge bulk with which they are now loaded down and lumbered up, would almost double their capacity by the very fact. But, as I stated, the loss by transferring the energy of the steam into that of compressed air I propose to save.

My plan is to propel the ship by jets of *live steam direct from the boiler*. To illustrate and enforce my meaning, I will take a ship of definite size, as I did in the case of the boat. It shall be a steamer which is using in her daily work a constant service of 5,000 horse power. Her boilers supply steam to that extent, and we have it at command. I propose to make no change in them; they go on doing their present work. All that I do is to change the direction of the steam pipe from each boiler. It no longer goes to the cylinder or cylinders. It goes to make its exit as directly as possible by the side of the keel.

This is a mighty change from all present plans. I am prepared to find my views rejected as being entirely unworthy of perhaps even investigation. I am prepared to find them presently adopted in, it may be, modified forms, for I believe that they embody true principles, which will prevail.

My designs in the case of the ship are identical with those which I specified in the case of the boat. The point of exit of the discharge pipe is lateral to the keel; the body of water on which the steam expends its projectile force is, in this instance, three feet in width, the longitudinal confining wall being at that distance from the keel.

In a ship of this size I propose that each jet be matched by one on the opposite side of the keel, and that there be two of these pairs, the first pair being 100 feet from the stem, and the second pair 250 feet. This, then, gives us our system of propulsion. Four pipes of ejection, at the points designated, are pouring forth a torrent each of steam directed backward, and, as before, slightly downward. At each of the orifices the issuing steam exerts constantly a force of 1,250 horse power, for this is what the boilers are steadily supplying. This terrible energy, almost appalling to contemplate, is expended on the open, or rather the confined, water beneath the ship's bottom, and the inevitable result must be a rapid movement of the ship.

No plan can be more simple and compact than this. The theory seems to me without flaw. Its efficiency can be demonstrated only by actual trial. Any one having a steam yawl at command can put the matter to proof with the expenditure of a very few dollars. Without injuring the boat in the slightest, a steam pipe, connected with the boiler, can be passed through her bottom and arranged as specified, and a thorough test made of the *principle*, for, of course, what the yawl will do the ship will do, *mutatis mutandis*, as nearly as yawls and ships work alike in common experience.

The condensation of the steam at the point of impact may be held by some as a source of loss; but, practically, it will be of no moment. The propulsive force of the steam is exerted at the instant of ejection, and not later. The condensation of the steam requires two elements, time and expansion, which are not present.

The advantages to accrue from this mode of *direct propulsion by live steam* are so exceedingly great that I most earnestly hope the trial will speedily be made.

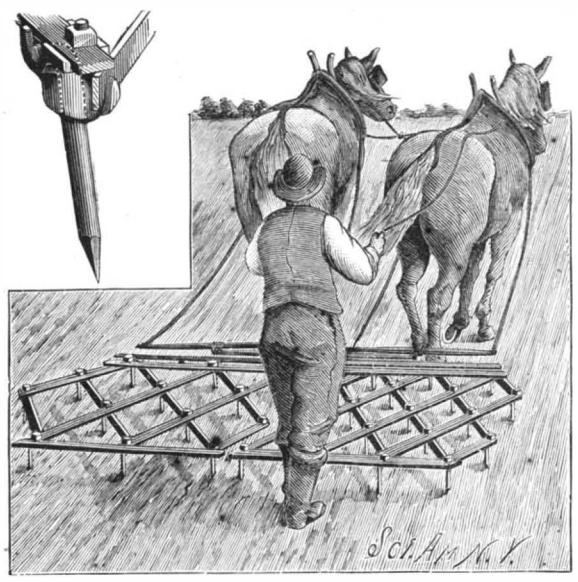
W. O. AYRES.

THE first almanac was printed by George von Purbach in 1640.

© 1886 SCIENTIFIC AMERICAN, INC

IMPROVED HARROW.

The frame of this light and strong harrow is composed of flat bars of iron or steel, arranged diagonally in two series crossing each other, the bars of one series being arranged flatwise and those of the other edgewise, the bars being connected with each other and with the harrow teeth by sockets placed on the bars at their intersections. The socket is a casting having a central vertical aperture, with a lateral recess for receiving the right-angled end of the harrow tooth. The lower part of the hole is flared to permit a slight lateral movement of the tooth, which turns on its right-angled arm as a pivot. Upon opposite edges of the surface of the socket are formed ribs, between which is received the bar placed flatwise. Between the ribs a stud projects upward from the face of the socket for receiving the apertured bar and a nut by which the bar is clamped to the socket. Upon the side of the socket is formed a hook for receiving the other flat bar, which is clamped in the hook by the bar placed flatwise above it. One socket is placed at each intersection of the bars. In addition to the diagonal bars, the studs of the end rows of sockets receive apertured bars, which are held in place by the nuts. One of these bars is connected by links or clevises, secured in bolt holes formed in the bar, with the eyener by which the harrow is drawn forward. It will be seen that by means of a simple socket at each intersection of the bars they are strongly clamped together, and the teeth are securely held in proper relation to the bars. By arranging the bars flatwise and edgewise, strength and rigidity are secured without undue weight. Any tooth may be readily removed and replaced without disturbing the others. This invention has been patented by Messrs. P. C. & I. A. Carstensen, of Walnut, Iowa.



CARSTENSEN'S IMPROVED HARROW.

IMPROVED CAR COUPLING.

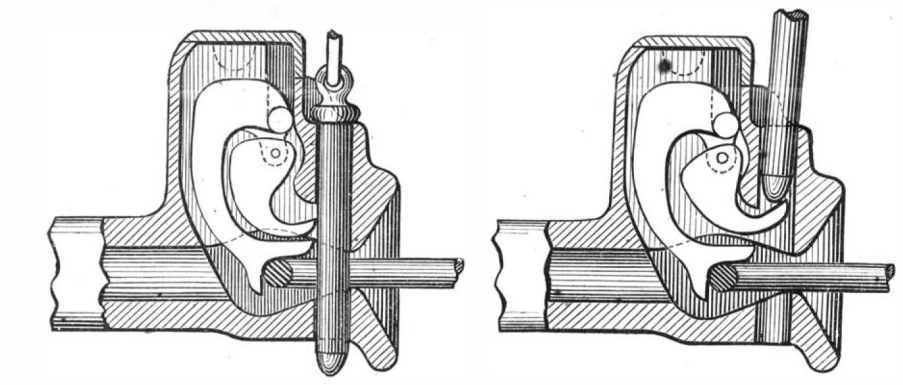
The car coupler herewith illustrated is particularly noticeable for the simplicity and admirable arrangement of its parts. The link is held in a horizontal position, so as to insure its ready entrance into the opposite coupler, while the pin is held elevated by a table which is pushed back by the entering link, through which the pin is then free to drop. The coupler is perfectly automatic in its action, and its reliability is assured, since the parts are so weighted that the force of gravity alone is depended upon. The drawhead opening is so formed as to permit the link to have all necessary vertical and lateral play without subjecting it to any but a tensile strain, thereby lessening the danger of breaking. As the only action required of the brakeman is to lift the pin, and as this can be done from either the sides or top of the car, he need not enter between the cars. The drawhead is provided with a wide flaring mouth terminating in a narrow throat, which serves to readily and certainly guide the link into position with reference to the pin. Beyond the throat the chamber for the link is enlarged to allow the rear end of the link to freely play up and down and sideways, to accommodate itself to the swaying and springing of the cars. Above this wide chamber is a narrow and parallel-sided one opening at the top of the drawhead. This opening is covered by a removable cap as shown. Pivoted in this chamber is a table free to swing, and, being heavily weighted in the rear of its pivot, it gravitates so that its foot or ledge is pressed strongly forward against or under the pin. From the rear portion of the foot a heel projects downwardly into the path of the link as it enters the chamber. Pivoted to the first or primary table just below its trunnions is a second table, which is weighted to gravitate forward, and has a foot lying normally just above the foot on the primary table. When the link is in its proper position in the drawhead, the foot of the primary table rests on its rear end (Fig. 2), the rebyholding its exterior end out horizontally from the drawhead in the position most favorable for coupling with another car.

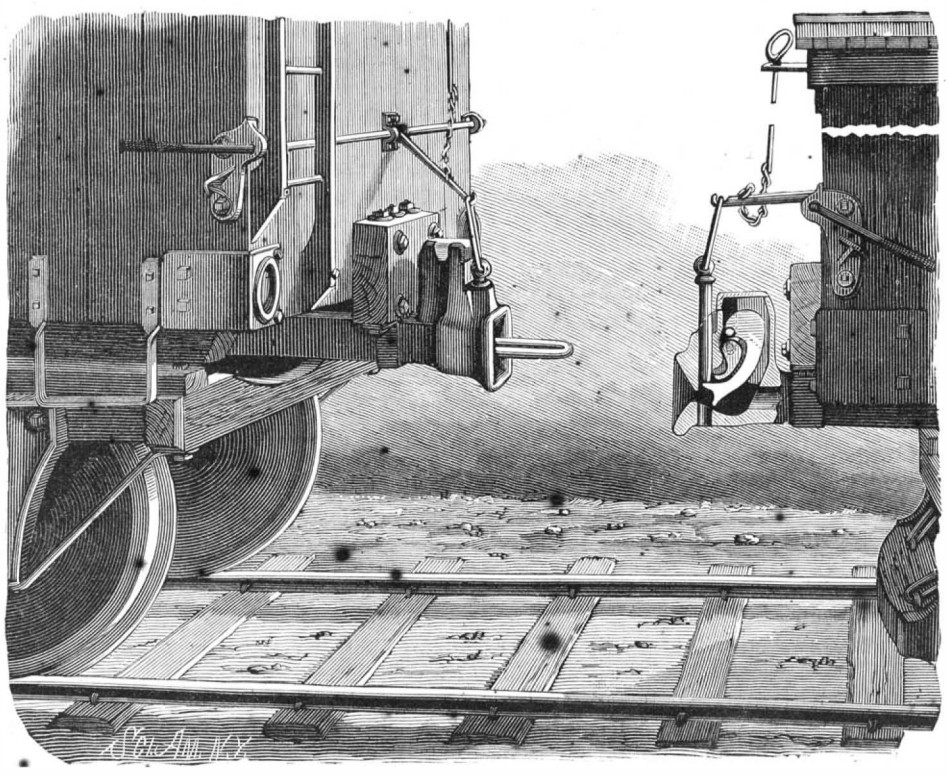
The construction of the parts is such that the weight of the tables is not always on the link, except when the cars are uncoupled and the link is presented for coupling. The weight of the tables never tends to carry the inner end of the link below the horizontal line; but the link, when the cars are coupled, may swing on the throat of the drawhead as a pivot until its inner end is far below the tables, and so leave the latter entirely suspended on their trunnions in the bottom of the vertical slots, in which they are free to move up and down. These slots or cups are formed at the top and on either side of the chamber, and receive the pivots or trunnions formed on the main table. This construction of the tables, whereby they are pivoted at their top in vertical cups in which they are supported and guided, enables them, when the cars are coupled, to freely swing forward and back or to rise and fall to accommodate themselves without danger of breaking to the thrusting in or jerking out of the link, as well as its frequent sudden elevation or depression, incident to the rocking, swaying, and jumping of the cars.

The pin is operated from either the top or sides of the car by means of a rock shaft extending across the end, as represented in the perspective view.

When in position for coupling, the pin rests on the foot of the primary table; the entering link strikes the hub, crowding it back and withdrawing the foot from underneath the pin, which is then free to fall. To uncouple, it is only necessary to lift the pin above both tables, when, the link still holding back the lower table, the secondary table is free to swing its foot beneath the pin, as shown in Fig. 3. When the cars separate and the link is withdrawn, the heavier lower table swings forward, taking with it the pivot of the upper table, which is thereby pressed against a stop and swung backward to withdraw its foot from beneath the pin, which then falls upon the foot of the primary table, and the parts are again in their first position ready for coupling. It will be observed that the only manual action required is the simple momentary swinging of a side lever against its stop; and that, after it touches the stop, the hand may be instantly withdrawn, the whole operation thereafter, both of uncoupling and coupling, being entirely automatic.

This invention has been patented by Mr. S. D. Locke, of Hoosick Falls, N. Y.

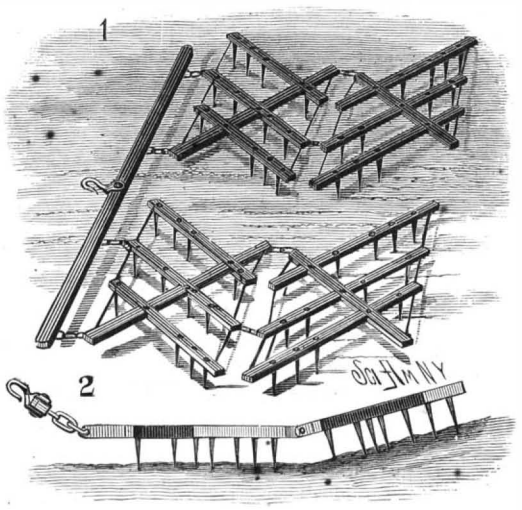




LOCKE'S IMPROVED CAR COUPLING.

IMPROVED HARROW.

This harrow, the invention of Mr. James G. Owen, of Covello, W. T., is made in two double sections, each comprised of front and rear parts, consisting of a series of tooth-carrying bars braced by a diagonal bar, and all connected at the ends of each part by spacing and brace irons. The tooth-carrying bars are set at an angle of about forty-five degrees with the line of draught, the front series ranging backward toward the left, while the rear series range backward toward the right. The front and rear parts of each section are coupled together by hinges, allowing independent vertical movement of all four of the harrow sections, and the front parts of each double section are coupled by suitable flexible bar, link, and staple connections with the draught beam, to which the horses are hitched. The teeth are fitted in the bars in such relation to each other as will cause them to harrow the ground in lines about two inches apart. As the harrow is drawn over the ground, the sections will adapt themselves to any inequalities of the surface in all directions, and no part of the ground will escape the proper action of the teeth. The converging arrangement of the tooth bars, together with the coupling of the front and rear parts by hinges, not allowing lateral play of one part on its connected part, causes the harrow to run truly and effectively on side hills, and without the tracking of one tooth in the path of the preceding one. This harrow is not liable to clog, and does not have a swinging motion from side to side; it may be made of either wood or iron.



OWEN'S IMPROVED HARROW.

Textile Soap.

The firm of Trawitz, Dueringer & Co., Strassburg, Alsace, manufacture a soap for use in the textile industry which it is claimed meets the highest requirements and perfectly replaces the best Marseilles soap. This "Luetzelburg textile soap," as it is named, according to the analysis made in the laboratory of the *Seifensieder Zeitung* contains:

Fatty acid	65·2 per cent.
Soda	7·6 "
Water	27·2 "
	100 "

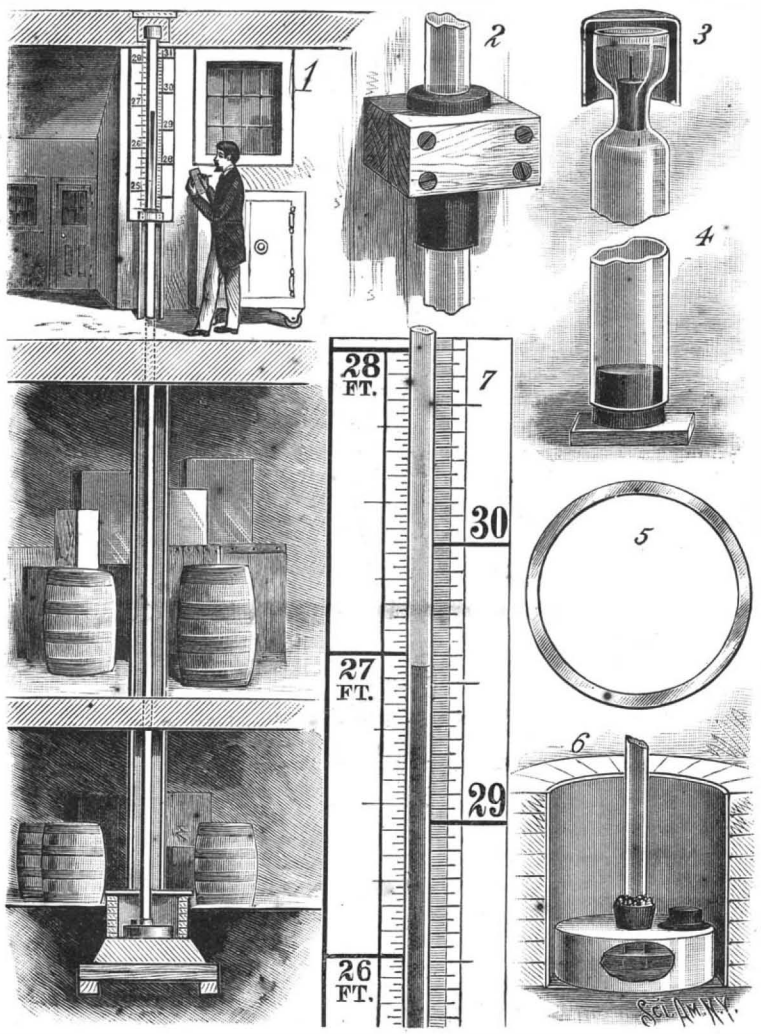
The fat is completely saponified and the soap absolutely neutral, and therefore suitable for any purposes of the textile industry.

A RUSSIAN engineer reports that he has discovered a process of reducing petroleum to a form of crystals which may be easily and safely transported to any distance and then reconverted into liquid form.

© 1886 SCIENTIFIC AMERICAN, INC

THE GLYCERINE BAROMETER.

Mr. Zopher Mills, Jr., a private merchant of this city, has recently shown a most praiseworthy devotion to science in erecting in his office building, No. 146 Front Street, a glycerine barometer. It is one of three known to be in existence at the present time. To avoid all trouble incident to the employment of joints, a glass tube several feet more in length than the full height of the barometric column of glycerine was used. Some trouble was experienced in procuring the tubes. Two perfect ones were finally drawn by Demuth Bros., Brooklyn, E. D. They are upward of twenty-nine feet in length and of about one inch internal diameter. The section of one is shown in full size in the cut, Fig. 5.



MILLS' GLYCERINE BAROMETER.

Naturally, trouble was encountered in their transportation from the glass house. Mr. Mills took a personal part in this work. Three men were required to carry the tube in its case. This was not on account of its weight, but because of the danger of breakage if any flexure took place for want of support. Having reached the place of destination, the next problem was the erection of the great inflexible tube into a vertical position within the building.

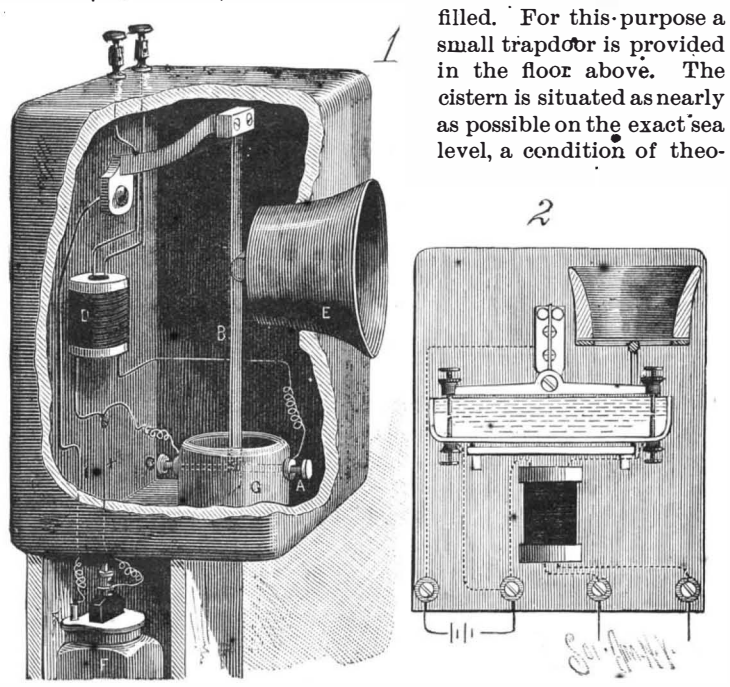
It was taken up to the roof. Holes were made through the roof and floors beneath large enough to pass it through. It was carefully raised to the vertical and lowered, its lower end passing through floor after floor until it reached the position shown in Fig. 1. The hole in the roof, not over two or three inches in diameter, was then closed. Thus placed, the tube extended from the cellar floor up through intermediate floors and above the ceiling of the second story. The cistern had to be in the cellar, or, rather, below the cellar floor. A watertight pit was prepared for the reception of a flat copper vessel, shown in a larger scale in Fig. 6. The support of the tube had next to be provided for. A collar of brass, with a projecting fillet or shoulder, was made slightly larger in diameter than the glass tube. It was secured to the tube by shellac and by a wrapping of string underneath it and between it and the tube. This collar is held in a wooden block, perforated, so as to catch the fillet, as shown in Fig. 2. The point of support is immediately below the scale. The tube and contained glycerine exert the stress due to their weight entirely on this block only. Or, more correctly, the weight of the tube and atmosphere, the two amounting to about 26 pounds, are here sustained. The lower end of the tube was introduced into the cistern and a cork placed in it and supported by a block. This arrangement can be seen in Fig. 4. Glycerine was then poured into the cistern and into the top of the tube. The shape of the top is shown in Fig. 3. It is contracted, so as to receive a cork. A brass cap is to cover it, to keep out dust. The lower cork being in place, glycerine was poured in through an inclined funnel, about four feet being filled each time. Some fifteen minutes were devoted to this operation. After some hours' standing, in order that all air bubbles might rise to the surface, the next four feet were filled. In this way glycerine was introduced until it stood above the stricture and the tube was quite full. The cork, Fig. 3, which is of India rubber, was then tightly inserted, the lower cork, Fig. 4, was withdrawn, and the column sank, leaving the Torricelli vacuum above it.

This completed the main operating parts of the instrument. A layer of kerosene was poured over the glycerine in the cistern and in the outside cup on the top of the tube, as a further measure of protection. A cover was placed over the cistern, a small aperture being left for the atmospheric pressure to act through.

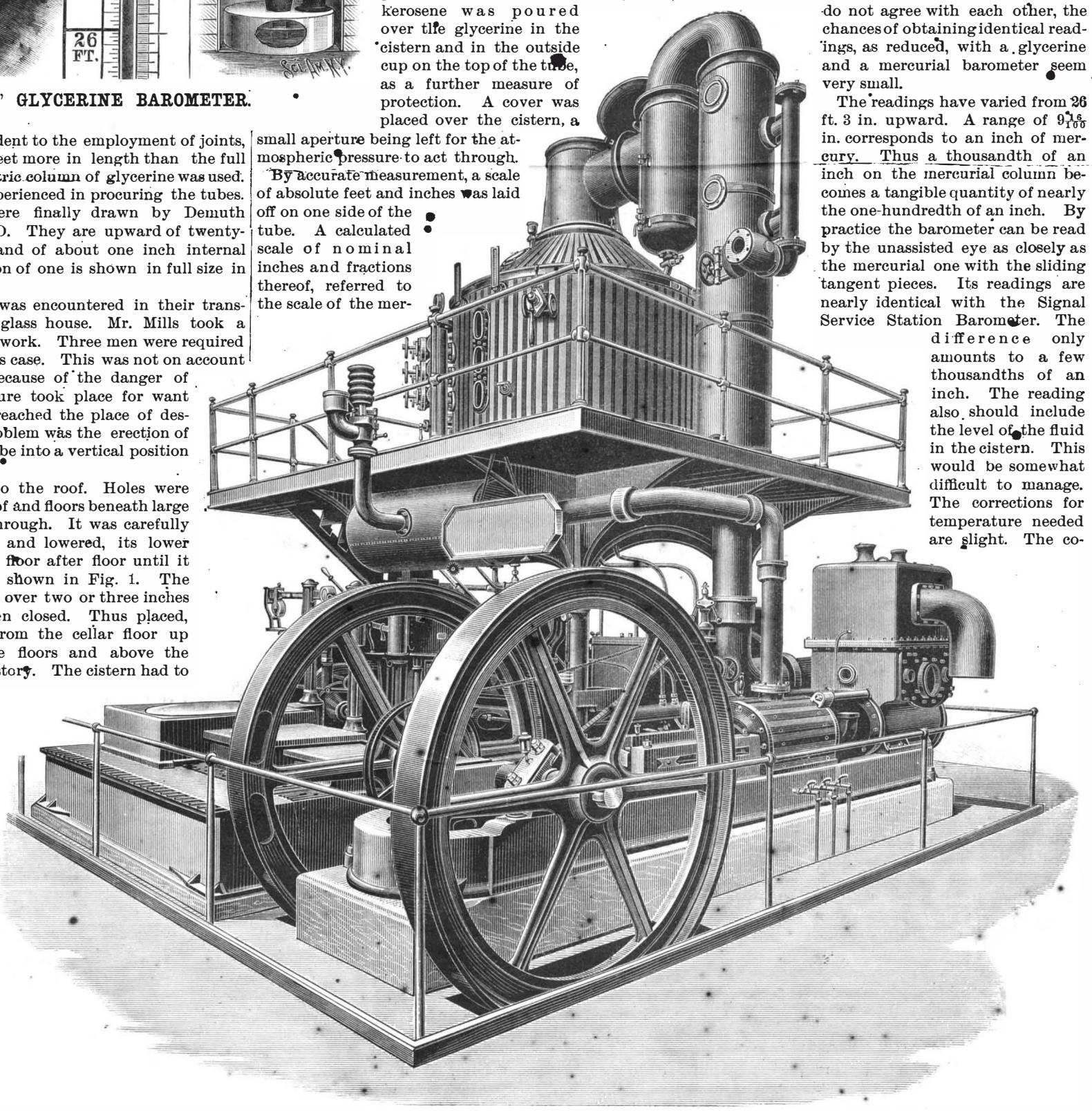
By accurate measurement, a scale of absolute feet and inches was laid off on one side of the tube. A calculated scale of nominal inches and fractions thereof, referred to the scale of the mercurial barometer, was placed upon the other side. These scales, with the tube between them, are represented in Fig. 7.

Access can be had from the upper floor to the upper end of the tube. If any air tends to accumulate in the vacuum, the bottom can be corked and the tube refilled. For this purpose a small trapdoor is provided in the floor above. The cistern is situated as nearly as possible on the exact sea level, a condition of theoretical interest as one rarely fulfilled in barometric stations. For constants in laying out the scale, the specific gravity of glycerine was originally taken at 1·250. This would be nearer the truth if 1·265 were taken, assuming the glycerine to be pure. But when it is remembered that the best mercurial barometers do not agree with each other, the chances of obtaining identical readings, as reduced, with a glycerine and a mercurial barometer seem very small.

The readings have varied from 26 ft. 3 in. upward. A range of $9\frac{16}{100}$ in. corresponds to an inch of mercury. Thus a thousandth of an inch on the mercurial column becomes a tangible quantity of nearly the one-hundredth of an inch. By practice the barometer can be read by the unassisted eye as closely as the mercurial one with the sliding tangent pieces. Its readings are nearly identical with the Signal Service Station Barometer. The difference only amounts to a few thousandths of an inch. The reading also should include the level of the fluid in the cistern. This would be somewhat difficult to manage. The corrections for temperature needed are slight. The co-



SARGENT'S TELEPHONE TRANSMITTER.
(FOR DESCRIPTION SEE NEXT PAGE.)



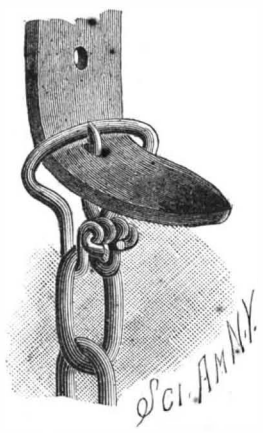
IMPROVED SUGAR EVAPORATING PAN. (For description see next page.)

© 1886 SCIENTIFIC AMERICAN, INC

efficient of absolute expansion of glycerine is 0·00045 for 1° C. In correcting a barometer, the absolute coefficient is the one to be used. Messrs. Black & Pfister, now of the Draper Manufacturing Company, of 152 Front Street, were the instrument makers who assisted in its construction.

COMBINED HOOK AND BUCKLE.

The wire of which the main portion of the buckle is made is bent to form an oblong loop, with parallel arms projecting from one of the longer sides; these arms are curved over toward the loop and provided at their extremities with eyes. The tongue is formed of a wire pointed at one end, and provided with an eye at the other end, which is placed between the eyes of the arms; a wire, forming the pintle of the buckle, passes through the eyes and has its ends bent over to hold the parts in proper position. The arms form a double hook for the reception of the link of a chain, a ring, or a wire rope, while the tongue may be used in the same manner as the other buckle tongues for engagement with the strap, a link of a chain, or a loop in a wire cord or rope. This buckle is useful for application to harness and saddles, and for the temporary repairing of straps and various kinds of rigging.



Further particulars can be obtained by addressing the inventor, Mr. James J. Pinkham, of Stillwater, Montana.

A Sure Investment—Dividend Every Week.

This issue closes the fifty-fifth volume of the SCIENTIFIC AMERICAN, and with it a considerable number of subscriptions expire.

Notices to this effect have been sent to many thousands of our present subscribers. But the quick response and rapid rate at which the renewals are being made, together with the accession of new subscribers, encourages the publishers to believe that before the middle of January they will have a larger list of old and new subscribers than has ever before appeared on their subscription books.

The fact that the public have lost money and confidence in many ventures leads them to seek new and better paying investments. This paper, established forty years ago, provides an opportunity of making an investment, the returns of which are sure and made weekly.

The security is unquestionable, and dividend guaranteed every week. The following are the conditions on which everybody can become a stockholder, and the public are cordially invited to examine the quotations herewith appended:

RATES FOR THE SCIENTIFIC AMERICAN PUBLICATIONS.

SCIENTIFIC AMERICAN	1 year,	$3.00
SCIENTIFIC AMERICAN SUPPLEMENT	1 "	5.00
SCIENTIFIC AMERICAN and SUPPLEMENT	1 "	7.00

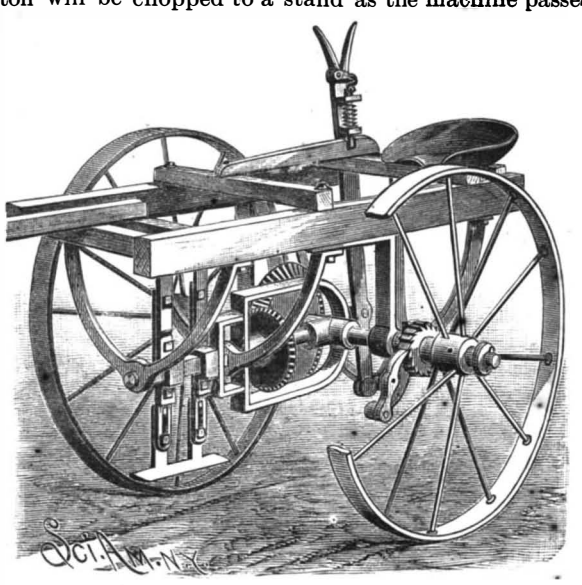
(Proportionate rates for half year.)

Now is the time to send in your names for the new volume of each publication, which commences next week.

The safest way is to remit by check, postal order, express order, or registered letter, made payable to the order of Munn & Co. Address all letters to 361 Broadway, New York.

COTTON CHOPPER.

This cotton chopper is so constructed that the cotton will be chopped to a stand as the machine passes



PULS' COTTON CHOPPER.

along the rows of the plants, leaving the hills of the plants at uniform distances apart. The axle revolves in bearings in the lower ends of hangers, whose upper ends are attached to the lower side bars of the frame. Upon the inner ends of the hubs of the drive wheels are formed ratchet wheels, with which engage pawls pivoted to the outer ends of arms, and which are held against the wheels by springs. The other ends of the arms are held to the axle by set screws. To the axle is attached a large beveled gear wheel, which meshes with a wheel on a shaft mounted so as to have a movement in the direction of its length. The forward part of the shaft is squared, and to it are secured two parallel slotted bars in which fit lugs formed on the ends of the shanks of the chopping hoes. The shanks are thus prevented from turning, and the hoes can be adjusted, by loosening the nuts of the holding bolts, to work deeper or shallower in the ground as may be required. By means of a suitably arranged lever, placed within easy reach of the driver, the shaft can be moved longitudinally, so as to throw the forward gear wheel into or out of gear with the main wheel mounted on the axle. The chopping hoes can thus be made to revolve or can be held stationary whenever required.

This invention has been patented by Mr. E. C. A. Puls, of New Braunfels, Texas.

TELEPHONE TRANSMITTER.

In the engraving upon preceding page, Fig. 1 represents a liquid transmitter, which is so wired that in its normal state the current circulates around the induction coil, D, with its full strength. The reason for this is thatthe vibrator is then nearer the screw, A, than the screw, C. The vibrator is actuated by the diaphragm of the mouthpiece, E, and its lower end enters, between the points of the screws, A C, the conducting liquid contained in the non-conducting vessel, G. It is evident that the strength of the current passing around the induction coil will be governed by the variations of the distances of the vibrator between the screws, and which are due to the action of the diaphragm in the mouthpiece. One of the many ways of wiring the instrument is clearly shown in the engraving. Another is to connect the wire leading from the positive pole of the battery where the negative wire is shown connected, and connect the negative wire with the wire of the screw, A.

Fig. 2 shows another construction of the transmitter, in which the vibrator consists of a centrally pivoted lever, which is actuated by the diaphragm in the manner illustrated. Each end of the lever carries a screw that projects downward into the liquid, so as to face a screw passing through the bottom of the vessel. The distance between each pair of screws will thus be varied by the movement of the diaphragm, and the strength of the current passing through the coil will be regulated accordingly.

This invention has been patented by Mr. F. G. Sargent, of Graniteville, Mass., who will furnish any further information.

IMPROVED SUGAR MACHINERY.

Among the exhibits in the machinery department of the Edinburgh International Exhibition, one of the most conspicuous is that of Messrs. A. & W. Smith & Co., Eglinton Engine Works, Glasgow, a specialty of sugar machinery.

The most conspicuous object in the group is a vacuum pan for the finishing process of boiling and crystallizing the sugar, of which we give herewith an illustration from *Engineering*. The heat is imparted by steam to the contents of pan through an inner bottom of copper and by a series of copper coils or worms; and the operation is conducted *in vacuo* by means of a neatly designed horizontal vacuum pumping engine.

This pan is mounted on a elevated platform (for convenience in discharging its contents into the hopper of the centrifugal sugar-drying machines), and the body and top of the pan are lagged by ebony and whitewood; the fittings and gauges are of argozoid, a new white metal, which gives the whole apparatus a very attractive appearance. The discharge of this pan is equal to six tons of dry sugar. The sugar, after having been concentrated and crystallized in the vacuum pan, is run into the hopper or mixed over the centrifugal sugar-drying machines of improved construction.

These machines are on the well-known self-balancing suspended principle, the cylindrical baskets which receive the sugar revolving at a high speed, and purging the sugar from any molasses which it contains. Each basket dries one cwt. of sugar at a charge. The dried sugar is discharged from the bottom of the baskets on to conveyers or bogies, as the case may be.

MERCURY BUBBLES.

BY T. O'CONOR SLOANE, PH.D.

Lord Rayleigh, in one of his recent addresses before the British Association for the Advancement of Science, made an interesting allusion to soap bubbles. He declared that one of the unsolved problems in natural science is comprised in the question, why soap and water form almost the only solution out of which reasonably large bubbles can be blown.

Both the formation of bubbles and globules can be produced with mercury exactly as with water. A quantity of the metal is placed in a vessel of glass, and water is poured over its surface to the depth of an inch. From a bottle more mercury is now poured into the vessel. The height of fall should be about six inches. As the falling fluid strikes the mercury in the vessel it acts as water falling into water does, with one exception. The latter carries air under the surface, forming bubbles filled with air. The falling mercury, instead of carrying air in its descent, forces water under the surface. Mercury is thirteen times as heavy as water. The water thus carried down instantly rises,

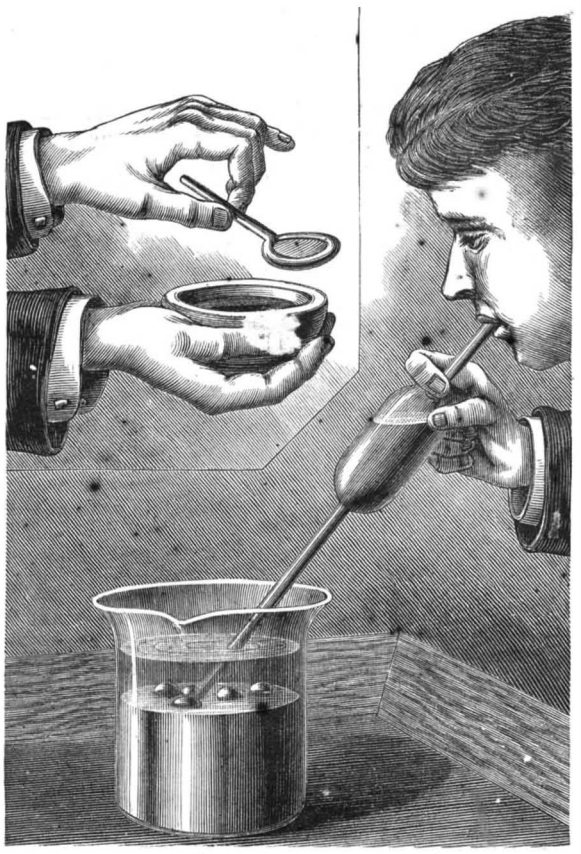
MERCURY FOAM.

and the exact reciprocal of the action described in the case of water and air takes place with mercury and water as factors.

As the water rises above the surface of the mercury on account of buoyancy, it picks up and raises a film of mercury. A hemispherical bubble is formed upon the surface of the fluid under the water. Water foam consists of incompletely spherical films of water filled with air. In the experiment just described, mercury foam is produced, the partial spheres of mercury film being surrounded by and filled with water. The fact that they are bubbles may be recognized by their shape. They form the characteristic line or angle of junction with the mercury on which they rest. They are evidently filled with water, for when they break no air escapes. They can be contrasted, with globlues that usually form upon the surface at the same time. These tend to run to the periphery of the vessel, and possess their characteristic spheroidal shape. Sometimes bubbles half an inch or more in diameter can thus be formed.

To demonstrate still further the analogy with water films, bubbles may be blown. A tube or pipette is filled with water. Its end is placed beneath the surface of the mercury, and bubbles are blown by forcing the water out of the pipette. As a rule, a far inferior effect is thus produced, but the method is of interest, and shows more clearly to what action the formation of these bubbles is due.

Finally, a flat film can be formed, such a one as water



BLOWING MERCURY BUBBLES—MERCURY FILM.

forms across the opening of a pipe or within a wire ring. A piece of copper wire about as thick as a steel knitting needle is bent at the end into a circle. The end must touch the wire at the bend, making a con-

© 1886 SCIENTIFIC AMERICAN, INC

tinuous circle. By bringing the bent portion in contact with a globule of mercury and some dilute sulphuric acid on a saucer, the wire loop becomes amalgamated or alloyed with mercury. Then, by sweeping it through mercury overlaid by water, with a quick skimming movement, a film can be picked up. Water will rest on its upper surface. This can be removed with blotting paper, leaving a pure mercury film. It must be held horizontal. It immediately breaks if an attempt is made to bring it into the vertical plane. The loop should not be much over a quarter of an inch in internal diameter.

FALL OF A GREAT WATER TOWER.

In various parts of the country it has become common, in connection with local water works, to erect slender towers or stand pipes for the purpose of maintaining the required head or hydrostatic pressure in the distributing pipes. The common method is to erect a simple iron cylinder or stack of, say, 16 ft. diameter and a hundred feet or more in height, into which the water is pumped and held like a cistern, the lower end of the cylinder being connected with one of the water distributing mains. In our paper for October 23, 1886, we gave an illustration of one of these stand pipes, as erected at Victoria, Texas, the upper end of which, not being at the time filled with water, had been damaged by a hurricane.

We now give illustrations of the far larger stand pipe of the Kings County Water Works, located at Sheepshead Bay, near Brooklyn, N. Y., which, at 1 P.M. on October 7, 1886, suddenly collapsed and fell, while being charged with water during a preliminary trial of its strength.

This stand pipe was 250 ft. high, 16 ft. in diameter at its base and for a height of 70 ft., then tapering upward for 25 ft., and then rising 8 ft. in diameter. A very strong and substantial foundation of concrete had been constructed, 33 ft. in depth below the surface of the ground. On this the stand pipe was built, the contractor being H. S. Robinson, of Boston, Mass.

In the construction of the work, the steel plates were hoisted to place by a derrick worked from within the tower, as indicated in the illustration at the left, which shows the structure partly completed.

As before stated, the explosion took place at 1 P.M., when the neighbors were startled by a rumbling noise followed by a crash like that of thunder. There was a slight vibration of the earth, but it was all over in less than thirty seconds. The people thought it was an earthquake, and rushed from their houses in terror. The shock was felt in all directions within a mile or two of Sheepshead Bay. A cloud of dust was seen rising from the locality, and when it had floated away the water tower was discovered lying on the ground, with tons of steel plates scattered in every direction. Great volumes of water rolled from and around the prostrate structure, and in a few moments nineteen acres of land was submerged.

Some water had been pumped into the tower a week previous to the explosion, but the real test was not made until the day of the explosion. It was supplied from drive wells in the immediate vicinity. The large engines were set in motion at the pumping station shortly after 11 o'clock. Two hours later the great tank was nearly filled, there being 227 feet of water in it, which would make about 400,000 gallons. The pressure was then 127 pounds to the square inch. It was noticed then that the tower leaked in some places, and Mr. Robinson prepared to mount the narrow iron ladder that led to the top of the structure, and make an examination. He approached within about five feet of the tower when he heard a rumbling noise like that of a rushing train, as he expressed it, and the plates for a distance of twenty feet from the ground parted and let loose the water. Others describe it as like the explosion of a steam boiler. The volume of liquid rushed out with great force, and Mr. Robinson was caught in it. He was carried nearly fifty feet by the wave, and that saved his life. Almost in the same moment a large section of steel plate weighing a ton or more crashed down upon the spot where he had stood. Another section weighing five tons was thrown fifty feet in an opposite direction. Small pieces were tossed all around the base of the tower.

Meanwhile, the tower, supported by the wire cables alone, tottered for a moment and then fell with a crash and roar in a northeasterly direction. The heavy steel plate, bolts, and braces were broken, bent, and twisted like so much paper. The rush of the water had stirred up clouds of dust, and for a time the scene was concealed from view. People in the immediate vicinity thought that the dust was escaping steam. When Mr. Robinson recovered himself, he was floundering in three feet of muddy water. His hat, coat, pocket-book, and a number of papers were gone. He struggled to his feet and waded toward a dry spot a quarter of a mile away. Though considerably bruised, he was not seriously injured. His pocket-book and clothing were found some hours later near the wreck. The soil about the tower was of a sandy character, and the water quickly disappeared, except in places where the sand was mixed with clay. Several acres of rye that had been planted by Mr. Stephens disappeared after the explosion. No other damage was done.

The following from the contract gives the particulars of the structure. The general conclusion appears to be that bad work in putting up the great pipe and poor material were the causes of its failure.

ROBINSON BOILER WORKS, 28 STATE ST., BOSTON, October 6, 1885.

BENJAMIN F. STEPHENS, ESQ., *President:*

I will make and erect on a foundation prepared by you near Coney Island, New York, a stand pipe 250 ft. high, as described below:

Pipe will be 16 ft. diameter up to 70 ft., then in the next 25 ft. taper in to 8 ft. diameter. Bottom of ⅞ in. steel, 17 ft. diameter. Bottom course connected to bottom by 6 × 6 × ⅞ in. angle iron, flange turned out; 15 braces on the inside.

First 5 ft. of pipe of ⅞ steel, with 3 rows of rivets in vertical seam; 30 ft. of pipe of ¾ steel, with 3 rows of rivets in vertical seam; 15 ft. of pipe of ⅝ steel, with 3 rows of rivets in vertical seam; 20 ft. of pipe of ⅝ steel, with 2 rows of rivets in vertical seam; 25 ft. of pipe of ⅝ steel (taper), with 2 rows of rivets in vertical seam; 5 ft. of pipe of ⅝ steel (1st course above taper); 30 ft. of pipe of ½ steel; 35 ft. of pipe of ⅜ steel; 30 ft. of pipe of $\frac{5}{16}$ steel; 30 ft. of pipe of ¼ steel; 25 ft. of pipe of $\frac{3}{16}$ steel.

For the first 75 ft. the course will be all inside, so at that height the diameter will be lessened by the thickness of the plates.

In the taper, the course will be all inside, and above that they will be large and small.

All of the plates will be steel stamped 60,000 lb. tensile strength. All of the vertical seams above the first 50 ft., and all of the horizontal seams, will be double riveted, with sufficient lap to make a good job.

I will rivet on to the outside of pipe a ladder running from top to bottom. Lower half of sides of 2 in. by ½ in. iron, upper half of 2 in. by ⅜ in. bar iron, and rounds of ¾ round iron 16 in. long and 12 in. apart.

I will rivet to pipe three manhole frames, position as shown on tracing, also two nozzles on bottom course.

I will rivet on to pipe two balconies (one under each of the upper manholes) with wrought iron brackets and floor as shown on tracing.

I will furnish and attach to the pipe twelve guys of 1 in. wire rope—six of them 100 ft. from the ground, and six 25 ft. from the top; the understanding being that you are to furnish and put down the anchors for same.

I will put around the top a 3 in. by 3 in. angle iron, and on the inside of the 25 ft. of $\frac{5}{16}$ iron I will rivet 4 in. by 4 in. T irons to stiffen the same. I will also rivet on 12 (twelve) 4 in. by 4 in. T irons to strengthen the joints where taper section of pipe joins the straight. Each piece to be 10 ft. long, and extend five feet above each joint and five feet below, eight of these T irons on lower joint, and four on the upper.

Price for the "stand pipe" completed as above, water-tight, and to your satisfaction, $16,625 (sixteen thousand six hundred and twenty-five dollars).

In the above price I have accepted your proposition to do the teaming from the dock at Bay Ridge or Long Island City to stand pipe site of all the material and tools used in the construction of said pipe for $350 (three hundred and fifty dollars).

Signed, H. S. ROBINSON,
By J. M. ROBINSON.

FALL OF A WATER TOWER AT KANKAKEE, ILL.

During a gale of wind on October 14, 1886, the water tower at Kankakee was overturned. The wind began blowing very strongly in the early morning, and reached an estimated velocity of sixty miles an hour. By 9 A. M. the tower was observed to be swaying slightly; the vibrations increased until the successive wind gusts raised it on one side or the other several inches at the foundation. An unsuccessful attempt was made to arrest this movement by tightening the nuts on the anchor rods, but the tower soon fell.

We quote the following particulars from the Kankakee *Gazette*:

"As the gale grew stronger, the tower with each vibration lifted itself further from its bed. Meantime, the top of the tower inflated and contracted like the sides of a panting horse. Then the windward side collapsed, forming a pocket extending downward from the top twenty-five or thirty feet, and the fall of the tower soon followed in a direction from the wind.

"The tower was 124 feet high and 20 feet in diameter. It was constructed of plates of ⅝ inch boiler iron, four feet wide and ten feet long, diminishing in thickness to No. 9 iron (one-eighth of an inch thick) at the top. It was intended to have iron rods across the top to act as braces and prevent a collapse. These were put on, it is said, but taken off for some reason. The tower was erected by the Sharon Boiler Works, of Sharon, Pa., under the direction of William Jones. The foundation was of stone and concrete, seven feet deep, about twenty-one feet in diameter, and rose about eight inches above the surface of the ground except on the side toward which the tower fell, where an excavation left the wall exposed for about a yard. Mr. Shannon, superintendent of the Water Works Company, computed the resisting or supporting capacity of the foundation at 160,000,000 pounds, while the tower when filled with water would have weighed only 22,000,000 pounds. Six anchor rods, two inches in diameter, extended from about six feet above the foundation into the foundation a distance of two feet, where they turned at right angles and ran laterally into the stone about two feet. One-third of the foundation, on the side toward which the tower fell, is broken down and sloughed off to a depth of three feet. Whether this crumbling began before the fall of the tower, or was caused by the weight of the tower as it leaned far over, we cannot say. On the windward side the rods were broken off."

John C. Hoadley.

On the 21st of October, 1886, death brought to a close the career of John Chipman Hoadley, of Boston, U. S., an American engineer whose breadth of attainments rendered him one of the leading men in the profession, especially in steam engineering, in which he was an authority equaled by few.

He was born in the State of New York in 1818, and his first engineering experience was in connection with the system of State canals, which was founded by the Dutch settlers in the seventeenth century, and increased from time to time as the needs of the day demanded. Leaving the State engineers' corps at the age of twenty-six, he became engineer for the construction and equipment of a number of mills at Clinton, Mass., devoting himself to the wide range of work necessary to build up a variety of industries, a task which could not be accomplished except by one possessed of unusual force, skill, and versatility.

Later, he became manager of a large machine shop in Lawrence, and for a number of years was engaged in the manufacture of locomotives and textile machinery. His experience with locomotives led him into an analysis of the dynamical relations which speed bore to the operation of engines; and the result of his investigations, partly mathematical and partly experimental, resulted in the invention of the Hoadley portable engine, which was probably the first application of scientific principles to the design of high-speed engines. These engines contained numerous radical features, since appropriated by others, notably the application of an automatic variable cut-off to a single slide valve, operated by a governor attached to the side of the driving pulley of the engine. We do not speak by the letter as to the exact limitations of Mr. Hoadley's inventions in this respect, as measured by the patents issued to him, but the fact remains that he was the pioneer in the successful application of the methods of construction of the Hoadley engine, which was manufactured in great numbers for many years.

During the later years of his life he separated from commercial and manufacturing affairs, and confined his attention to the practice of his profession in consulting engineering and as an expert in patent causes. In this latter capacity his services were held in highest repute, his retentive memory rendering an extended reading and wide experience tributary to a power of keen analysis which would set forth the measure of each patent's merits or the worth of the mechanical features of an invention.

His acquirements were not limited to technical matters, but extended through a wide range of general culture. The transactions of the American engineering and scientific societies contain frequent contributions from his pen; the members of the British Association may recall among these his paper on "American Steam Engine Practice in 1884," read at the Montreal meeting, and which was the first step in the recent polemical engineering papers respecting English and American railway practice.

Mr. Hoadley was always interested in public affairs, but he held few offices. He was, however, the engineer member of the Board of Health of the State of Massachusetts. He also visited England and the Continent in 1862, on the part of the State Government, making an examination of fortifications for the purpose of devising a system for American sea coast defences.

The professional work of Mr. Hoadley is shown by its influence over a wide range of engineering practice in mill work, applications of steam, sanitary engineering, and methods of expert evidence, rather than in any massive structures which bear his name as builder. In his personal address he was especially genial, and endeared himself to a large number of friends.—*London Engineering.*

Improved Lock for Firearms.

In our issue of December 11 we described and illustrated an improved lock for firearms, invented by Mr. Charles E. Goodwin, of Saybrook, O. We omitted one important feature: A single pull of the trigger will fire both barrels consecutively. By properly adjusting the arms of the sears, both barrels can be cocked at the same time and fired simultaneously or consecutively, as may be desired; or, when both are cocked, one can be fired and the other not.

© 1886 SCIENTIFIC AMERICAN, INC

RECENT TYPES OF THE GATLING GUN.

The accompanying illustrations represent improved Gatling guns; one mounted on a tripod and the other on a carriage, and showing different methods of supplying cartridges to the gun.

Fig. 1 shows a small six-barreled gun, mounted on a tripod. This gun weighs 78 pounds. It uses what is known as the Accles' positive feed, which eliminates the liability of the jamming of the cartridges, and which has increased the rapidity of fire to the extraordinary rate of 1,200 shots per minute. One hundred shots have been fired from the gun in two and two-tenths seconds. The fire can be made continuous, or the delivery can be made in salvos of 30 or 40 shots per second. The latter mode of firing would prove beneficial when the gun is being fired on shipboard in a rolling sea, a pointing lever being attached to the gun to enable the gunner to give it proper aim.

With the introduction of the positive feed to the Gatling gun, two kinds of high angle fire are made effective. These may be classed as direct and indirect; direct when the gun is aimed and fired at any elevated object; indirect when the bullets are fired up in the air, in order to hit the object in their fall. This latter mode of firing can be made very effective in getting men out of intrenched positions. Musket balls when fired from the gun at high elevations remain up in the air for 57 to 58 seconds, and when they fall they strike the ground with sufficient force to penetrate two inches of timber. This high angle fire greatly increases the power and value of the gun as a weapon of war.

The Gatling is the only machine gun that can deliver high angle or mortar fire, and is doubtless one of the most effective arms of its size in the world. Official reports say: "The feed is positive in action and entirely independent of the force of gravity. The feed is all that is claimed for it. It is believed the modified Gatling gun with the new feed has reached the utmost limit of improvement."

This light gun is designed for naval service, for mountain warfare, for cavalry service, for police use in cities for suppressing mobs, for use on board of railway trains, for protecting and guarding treasures shipped by express, etc.

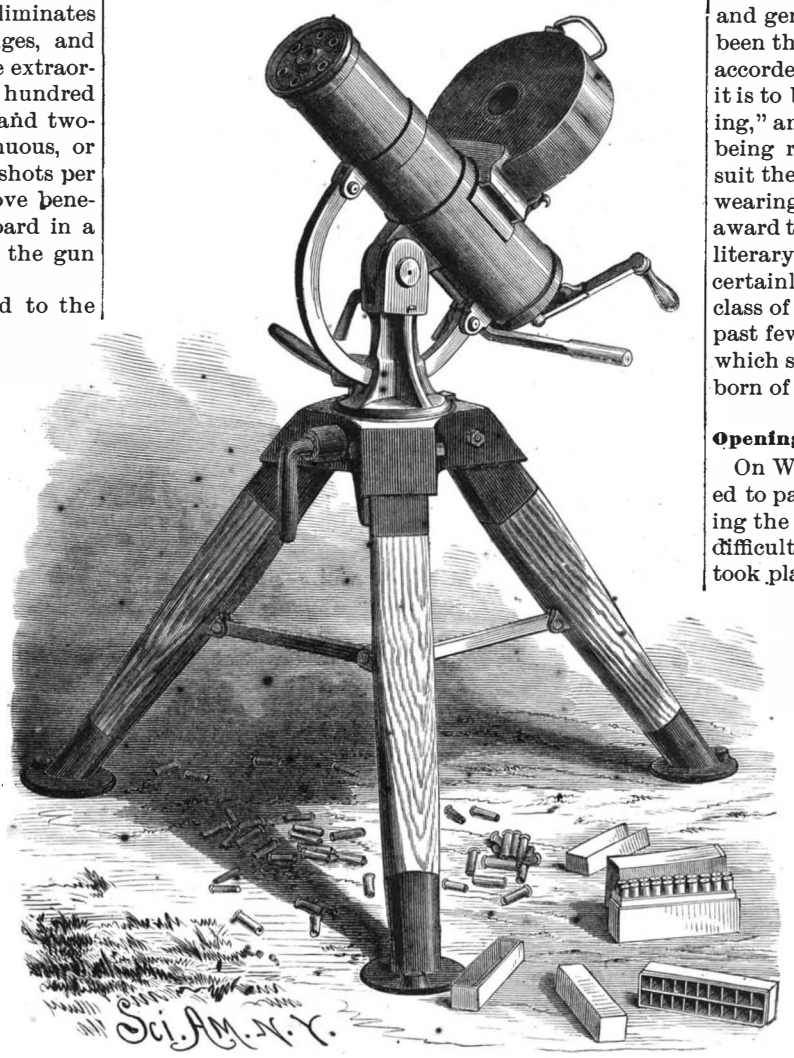
With this new feed, the firing and loading can go on uniformly and incessantly, even when the gun is worked by men inexperienced in its use.

This gun would prove of great service in defending such positions as villages, field entrenchments, and for the defense of caponniers, for covering the approach to bridges or *tetes-de-pont*, for defending a breach, and for employment in advanced trenches, or in field works where economy of space is often of the utmost importance; for use on shipboard to clear the enemy's decks or open ports, and from top-gallant forecastle, poop deck, and tops of vessels of war, for the defense of sea coast batteries against the attack of boats, for assisting in keeping down the fire of ships engaging forts at close quarters or attempting to force a passage by pouring an incessant fire in their ports, and in clearing breaches and other proposed places for landing from boats, it would be most effective. Fig. 2 represents a light ten-barreled Gatling gun, mounted on a carriage. This gun uses what is known as the Bruce feed. This improved feed allows the cartridges to be fed to the gun at the rate of over 1,000 shots per minute, directly from the paper boxes in which they are originally packed. For continuous and direct fire this kind of feed makes the gun very effective. Various calibers of Gatling guns are made.

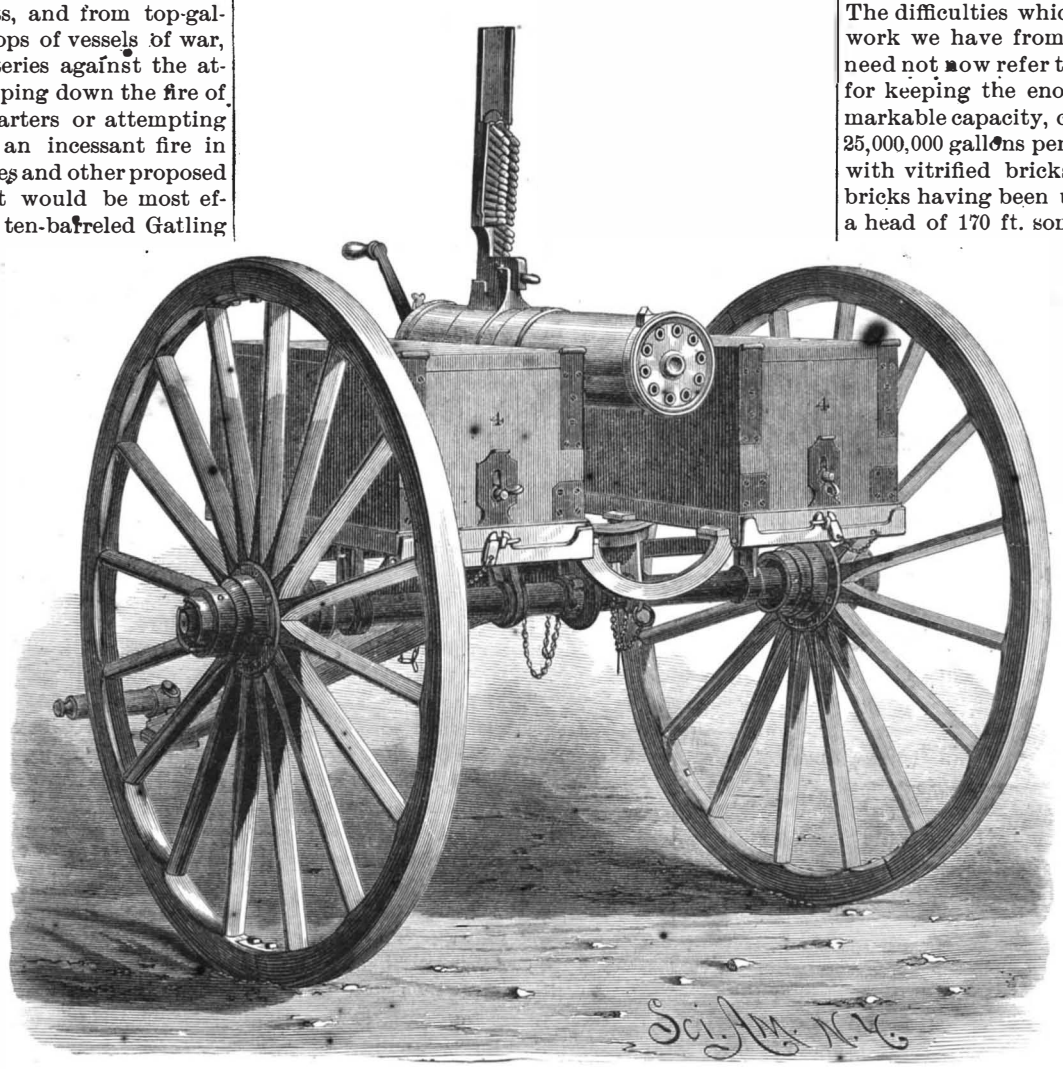
Among the advantages of the musket caliber Gatling gun may be enumerated: The lightness of its parts, the simplicity and strength of its mechanism, the rapidity and continuity of its fire without sensible recoil, and its accuracy and effectiveness against troops at all ranges attainable by rifles. Also its peculiar power for protecting roads, defiles, and bridges; for silencing field batteries and batteries of position; for increasing the infantry fire at the critical moment of a battle; for supporting field batteries and protecting them against cavalry or infantry charges; for covering the retreat of a repulsed column, and its economy in men for serving it and animals for transporting it. The relation which the machine gun is to occupy to the different arms of the service will, no doubt, ere long be prescribed and settled by competent authority.

The superiority and great value of the Gatling gun as an auxiliary arm of both the military and naval service having been clearly demonstrated, it is evident it will be extensively employed in any future wars.

The day is not far distant when machine guns in large numbers will be considered indispensable on the battle field, in forts, and on shipboard, and the nation that is best provided with these arms, and has its soldiers and sailors drilled to serve them in the best manner, will best preserve the welfare and lives of its people. Gatling guns are manufactured by the Gatling Gun Company, of Hartford, Connecticut, U. S. A.



NEW SIX-BARRELED GATLING GUN MOUNTED ON TRIPOD.



LIGHT TEN-BARRELED GATLING GUN ON CARRIAGE.

Scribner's Magazine for January, 1887.

The appearance of a new first-class monthly magazine, issued by a firm of such high standing as Messrs. Charles Scribner's Sons, under whose name had already been achieved one of the most conspicuous successes of modern magazine literature, is an event of considerable moment in the world of letters, and the contents and general style of make-up of the new monthly have been the subject of a degree of public attention seldom accorded to any literary venture. Of the first number it is to be said that the contents are all "good reading," and that the typography is excellent, the type being rather large, and of a style just calculated to suit the eyes of those who are beginning to think of wearing glasses. There is nothing to which we would award the palm of superlative excellence, either in the literary matter or the illustrations, but the whole is certainly up to the high average which readers of this class of literature have been favored with during the past few years, and there is about the magazine a look which seems to say plainer than words that it was not born of yesterday, and that it has come to stay.

Opening of the Severn Tunnel to Passenger Traffic.

On Wednesday, Dec. 1, the Severn Tunnel was opened to passenger train service. The ceremony of turning the first sod in the commencement of this, the most difficult bit of tunnel engineering ever entered upon, took place in March, 1873, now nearly fourteen years ago. The passenger service would, however, have been commenced some time since, but for the delay in the completion of the lines connecting the tunnel with the main system, a delay dictated by prudence when the stupendous difficulties in the prosecution of the work caused the delay in the completion of the tunnel itself, and some fear that considerable time might elapse before the whole of the difficulties could be overcome. The greatest caution has been exercised, and although the very able contractor, Mr. T. A. Walker, had completed the tunnel, the engineers deemed it advisable to start with goods service only for a short time. In his report to the Board of Trade, Colonel Rich says: "The works appear to be very good and substantial, and to have been carried out with great care and judgment. The difficulties of dealing with the large quantities of water, and particularly of dealing with the underground stream, which runs at a great velocity, have been considerable, but have been successfully overcome, and the result is a tunnel of unusually large dimensions which is particularly dry. The top of the tunnel is about 145 ft. under the level of high water spring tide, and about 50 ft. under the bed of the river at the deepest point. The means of ventilation are ample." The fan for the latter purpose, we may mention, is 40 ft. in diameter, and is made, like those for the Mersey Tunnel, by Messrs. Walker Brothers, Wigan, to exhaust 400,000 to 500,000 cubic feet of air per minute. The difficulties which have been encountered in this work we have from time to time described, and we need not now refer to them. The pumping machinery for keeping the enormous water influx down is of remarkable capacity, capable, it is said, of raising over 25,000,000 gallons per day. The tunnel has been lined with vitrified bricks set in cement, about 75,000,000 bricks having been used for this work alone; but with a head of 170 ft. some good work is necessary to keep water out. The passenger service was commenced without ceremony, as some connecting lines for the main service have yet to be made. This tunnel is about 4¼ miles long, and has cost nearly $10,000,000. For illustrations and full description see SCIENTIFIC AMERICAN SUPPLEMENT, No. 539.

MR. L. TIETJENS, of Stassfurt, Germany, has recently patented an ingenious method of damming back the flow of water in shafts by the application of the well known fact that certain salts increase their volume very materially by the absorbing of water of crystallization in hardening. To accomplish this, he takes either calcined soda, anhydrous alum, kieserite, or oxychloride of magnesium, mixes them into a paste, and then immediately injects them through a suitably arranged pipe into the fissures through which the water flows. It is said that as this paste hardens, it swells enough to fill all the interstices of the rock and to render it water tight.

© 1886 SCIENTIFIC AMERICAN, INC

TRICHECHUS AMERICANUS—MANATEE.

BY W. O. AYRES.

Strange-looking animals these are which we have here represented. They have been classed by some writers near to the whales, that is, among the cetaceans; and yet they are by no means closely allied to the cetaceans. And then, again, others have ranked them with the pachyderms, and in alliance with the elephants, etc. But the most recent writers, of suitable authority, set them by themselves in a designated group, to which is given the name of *Sirenians*. Of these are now existing but two genera, though one other has become extinct within a little more than a hundred years. These two are the *dugong*, *Kalicore dugong*, and the *manatees*, *Trichechus*, one species of which is figured for us here.

A common name, which is sometimes applied to them all, of the various types is sea cow; and the total disappearance of the sea cow of Behring's Island is a curious instance of the rapid and complete extermination of an animal of huge size, which at its discovery was abundant.

The facts are these: When Behring discovered the island to which he gave his name, a very large Sirenian fairly swarmed in the creeks and shallow waters of its shores. It was well described by Steller, the naturalist who accompanied him, and the specimens which he took home to St. Petersburg were, until quite recently, the only ones available. But in 1883 the Smithsonian Institution received from Dr. Stejneger a very valuable collection of skulls; in fact, almost complete skeletons. The animal was larger than either of the Sirenians now in existence—20 to 28 feet long. It constitutes the genus *Rhytina*.

Like all the Sirenians, it was very gentle and affectionate in its disposition, and Behring's sailors tamed them readily; but, alas! for the poor sea cows, their flesh was excellent for food, and the sailors took advantage of their gentleness, and by 1768 not a single *Rhytina* could be found on Bhering's Island—the only known place of their residence—and none others have ever since been seen. Steller's sea cow is, without doubt, extinct.

The *Sirenians*, as already noted, are of very peculiar formation. They have no hind limbs whatever externally manifested, resembling the cetaceans in that respect; but their fore limbs are very strong, large, flat, flipper-like, and remarkably flexible. The bones of the entire skeleton are denser and heavier than those of any others of the mammalia. The flesh of all is, like that of the *Rhytina*, much prized as an article of food.

The skin is coarse, heavy, and resembles that of an elephant, having short, stiff hairs scattered about on it, but nowhere thickly, the general color being dark, almost black. The eyes are small, the nostrils large, provided each with a valve.

These characters are common to the dugong and the manatees. Of the latter—*Trichechus*—there are two species, an African, *T. senegalensis*, and an American, *T. americanus*, which is the one before us, and of which only I will here speak.

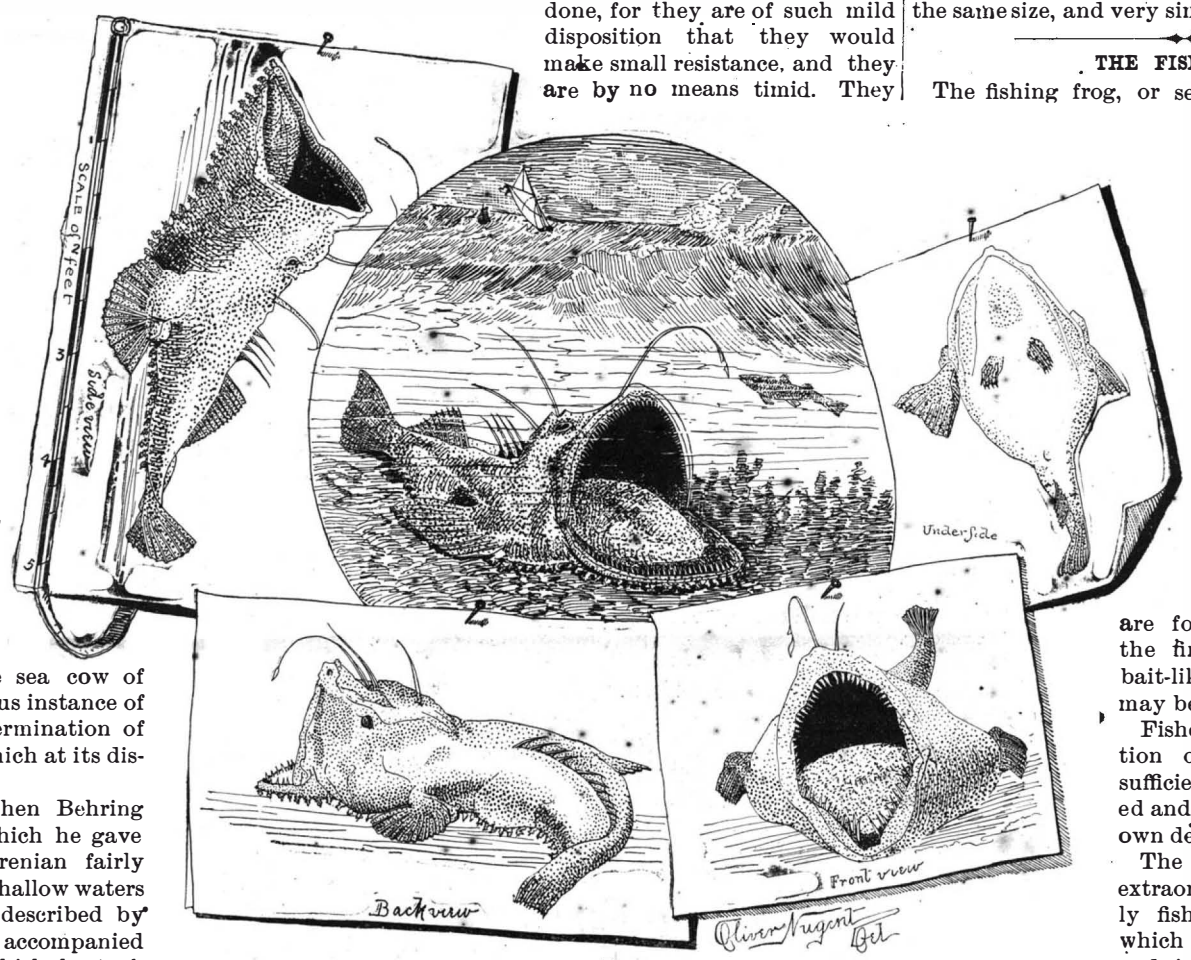
Trichechus americanus is a native of our whole eastern coast from the southern to the northern tropical limit and a little beyond, that is, from Brazil to Florida, including the West India Islands and the Gulf of Mexico. It should be mentioned that an attempt has been made to separate the northern type, those of Florida, as a distinct species, under the name of *Trichechus latirostris*, but it is perhaps more probably only a climatic variety.

The manatees have seldom been captured and brought away for exhibition, though it might easily be done, for they are of such mild disposition that they would make small resistance, and they are by no means timid. They frequent the shallow lagoons, and an easy arrangement of nets could capture them. Two small ones, about six feet in length, were exhibited in 1875, and one smaller still was shown only a month or two since by Messrs. Reiche Brothers, of New York, importers of such curiosities, from which our representations are made.

Its attitudes are well shown by the figures. It was said to have been brought from Brazil. It breathed in one to one and a quarter minutes, the valves of the nostrils opening as it rose to the surface and closing as it went below. This species grows to the length of 12 to 15 feet. It ascends the South American rivers freely, following the Amazon far up into the mountains.

The dugong is found in the Red Sea, the Indian Archipelago, Mauritius, Australia, etc.

It is closely allied to our manatee, and is of about the same size, and very similar to it in habits.



THE FISHING FROG (LOPHIUS PISCATORIUS)—A STUDY FROM LIFE.

THE FISHING FROG.

The fishing frog, or sea devil, as it is sometimes called, owing doubtless to its repulsive appearance, is conspicuous principally for its peculiar method of alluring its prey. Its head is of enormous size, and the feature that is not least pronounced is its prodigious mouth, which extends, not from ear to ear, but half way around the front part of its head, and is fortified with rows of teeth which may be raised or depressed at will, according as the prey is entering or striving to escape from its place of captivity.

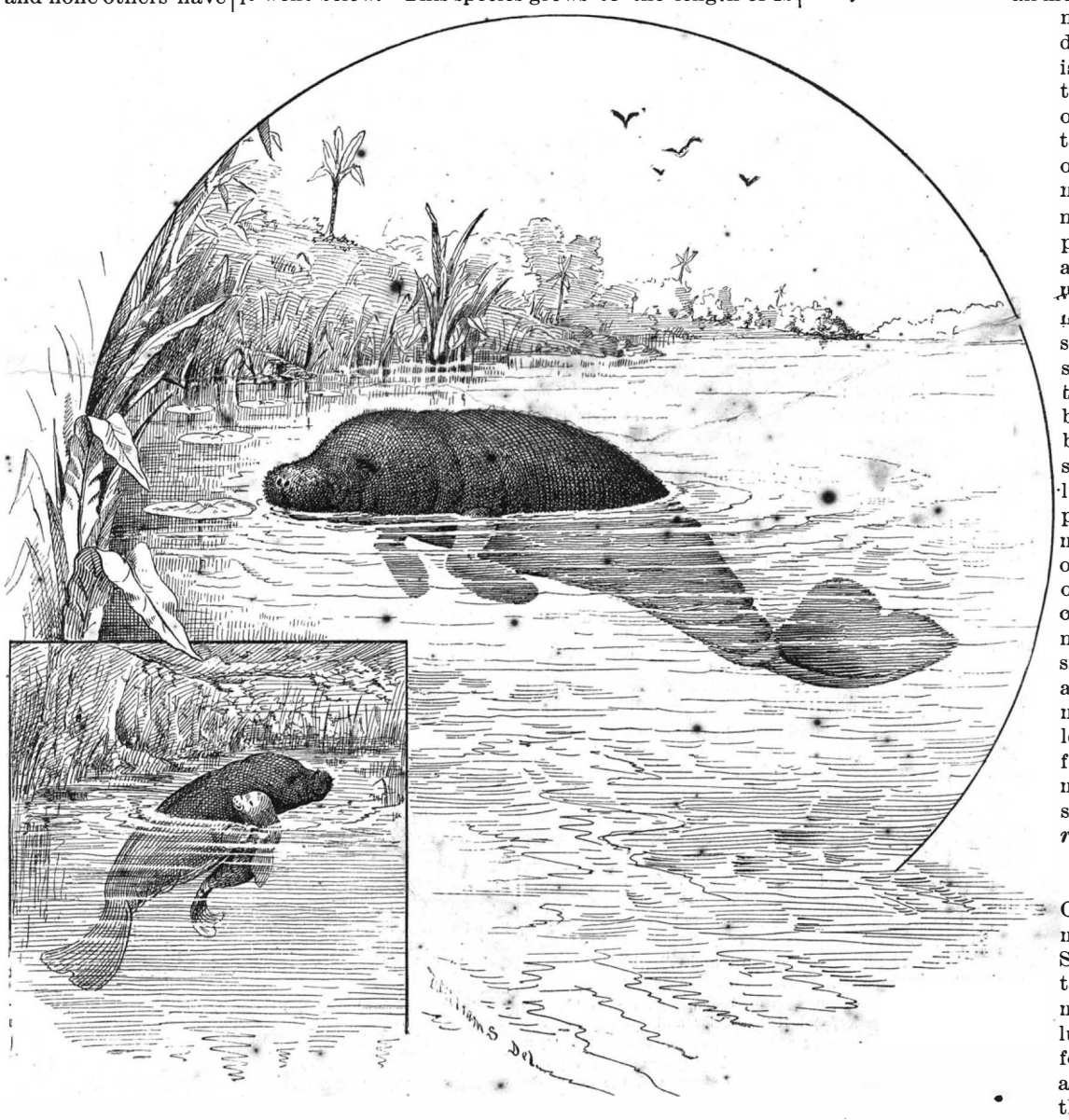
Along the top of the head are found three long filaments, the first of which terminates in a bait-like appendage, and which may be waved in any direction.

Fishes are attracted by the motion of this object, and when sufficiently near, the mouth is opened and the prey is sucked in to its own destruction.

The stomach is distensible to an extraordinary degree, and frequently fishes are discovered therein which are nearly equal in weight and size to the fishing frog itself.

The head is provided with a moss-like fringe, which extends around its entire circumference, and which enables it to conceal itself easily among the seaweeds and mosses on the bottom of the sea, where it is its pleasure and custom to extend and bury itself in wait for its victims.

The specimen from which the drawing was made was captured near Flushing, Long Island, by Dick Hill, son of the celebrated sporting man Harry Hill, of this city. It was 5 feet long, and weighed 125 pounds.



THE MANATEE, OR SEA COW.

EQUALITY.—That all men have equal rights is a cardinal doctrine in the theory of democratic government, but it is possible to expand the claim to a point beyond the bound of rights simply, and apply it to the results of the exercise of our inalienable endowments. Human beings are not born with equal gifts and powers. Wherever there is an upper and middle, there must be an under. The weak must seek the wall and be the stile from which the ambitious strong will vault toward the top. Nor can those appointed by nature for the pyramid's base serve in any other position. To press the wall as little as possible, get all the pay for service that it demands, and make the "best of now and here," is the bound of their possibilities. Without a foundation there can be no superstructure, and the position is as truly honorable as any other, though universal mankind have held it to be less desirable. All theories for the help of those who serve must proceed upon an admission of inequality.—*The Carriage Monthly.*

THE American Forestry Commission, at its annual meeting held at Denver, Col., September 15, recommended to Congress the establishment in the District of Columbia of an agricultural and forestry experimental station, and the passage of a bill for the protection of the government timber lands.

© 1886 SCIENTIFIC AMERICAN, INC

ENGINEERING INVENTIONS.

A car coupling has been patented by Messrs. Jacob W. Baker and George A. Prescott, of Dover, N. J. This invention relates to the construction of a novel form of drawbar and connections, to be used with the ordinary form of coupling link.

A boiler feed regulator has been patented by Mr. Charles O. Wyman, of Anoka, Minn. The invention consists of a tank with pipes connecting it with the boiler above and below the water line of the latter, and with pipes leading to the pump, with various novel features, to keep the water at all times at the proper height.

A reversing mechanism for engines has been patented by Mr. Lorin C. Forwood, of Shipman, Ill. It consists in an eccentric held between collars secured to the main shaft of the engine, with sliding wedges arranged to move the eccentric transversely across the shaft, by which the reversing of the valve motion is effected, without the ordinary joints and rods required where links are used.

An automatic water feeder for steam boilers has been patented by Mr. Charles O. Rabut, of New York city. It embraces a system of valves operated by a float controlled by auxiliary floats, and also in an arrangement of an air valve to permit the escape of air during the filling of the float chamber, all of the working parts being inclosed by a casing, except when registering mechanism is employed.

A valve for hydraulic elevators has been patented by Mr. Parker F. Morey, of Portland, Oregon. This invention comprises a system of differential valves controlled by an auxiliary valve, and thus governing both the admission and the escape of water from the ram of the elevator, with provision for arresting the motion of the ram, as required, to stop the elevator, the design being also to prevent excessive wear from sand or grit.

MECHANICAL INVENTION.

A machine for making whiffletree bolt blanks has been patented by Mr. John Stacker, of Winsted, Conn. In this machine a new form of anvil or die is employed, on which the heads of the bolt blanks are flattened, split, and spread or opened, in connection with a new device for splitting and opening the bolt, so that all the operations may be conducted with dispatch on the same machine.

AGRICULTURAL INVENTIONS.

A combined corn planter and cultivator has been patented by Mr. John C. Weiss, of Sheldon, Mo. The object of this invention is to improve the construction of a machine heretofore patented, involving novel features and combinations, to render the machine more convenient in use and more reliable in operation.

A harvester for sugar cane, corn, etc., has been patented by Mr. Samuel H. Pearcy, of Franklin, Tenn. This invention covers a novel construction and combination of parts in a machine to be drawn by teams on fields of standing crop, and automatically cut the standing canes and strip them of their tops and leaves, and drop them in bunches while passing along the cane rows.

MISCELLANEOUS INVENTIONS.

A rein muff has been patented by Sarah J. Hull, of Stella, Neb. One end has a flap secured to one side and constructed to be folded over the end and secured to the opposite side, so that the reins and whip may be held in the hands and the latter be at the same time protected by the muff.

A carpet stretcher and tacker has been patented by Messrs. Adelbert H. Noyes, of Jefferson, and Frederick G. Noyes, of White Water, Wis. It has a staff and barrel, to the lower end of which is attached a toothed carpet stretching and holding head, in connection with a tack holding tube, and a foot pedal so arranged that the tacks may be driven thereby.

A mould for soles and heels of boots or shoes has been patented by Mr. Darius Banks, of Morrisville, Pa. It is for forming the heel and sole together of rubber or other plastic material, by simply pressing the latter into the mould by hand and permitting it to harden, the form being shaped and withdrawn from the mould in a manner not attainable with a solid mould.

A clevis has been patented by Mr. Arthur W. Rumsey, of New Kiowa, Kan. It is more especially designed for attachment to agricultural implements or machines, and provides a simple, inexpensive, and effective device, which may be quickly and easily coupled or uncoupled, but which will not uncouple accidentally.

A moulding machine has been patented by Mr. Samuel C. Burris, of Victoria, British Columbia. It has upper and lower cutter beads for simultaneously surfacing and grooving opposite sides of timber, with cutters arranged at an angle to the line of motion of the timber, and other novel features, to improve the construction of woodworking machines.

A miner's safety lamp has been patented by Mr. August J. Becker, of Mount Carmel, Pa. The invention consists of various parts and details, making a lamp which cannot be opened by the operator without extinguishing the light, and in which the light is extinguished when brought into contact with the fire damp.

A facing tool has been patented by Mr. Alfred H Donnally, of Foxburg, Pa. The invention consists of a face plate carrying cutters and having ratchet teeth, a ratchet lever and pawl operating on the face plate, and there being a feeding device for the face plate, the tool being specially adapted for truing up the faces of oil well joints.

A combination ladder has been patented by Mr. Christian Koerner, of Rochester, N. Y. It is a step ladder connected with an auxiliary section by separable hinges, the auxiliary section having one or two additional sections, and one of the sections having a short ladder acting in conjunction with the section to form a trestle for supporting a stage.

An ax has been patented by Mr. Nicholas Goodier, of Dardanelle, Ark. The ax body has a transverse groove, and a deeper slot at right angles thereto, to receive a corresponding tongue and projection on a detachable bit, the parts being rigidly united by a bolt passing through the projection, so the cutting blade is detachable and can be renewed when worn or destroyed.

An adjustable balcony has been patented by Mr. Gottlieb D. Husemann, of St. Louis, Mo. This invention covers a novel construction of folding balcony, which can be readily removed and folded in small space for storage, especially designed in washing the outside of windows, being so constructed that it can be easily adjusted in operative position in any window of any story.

A bicycle handle has been patented by Mr. Robert Rodes, Jr., of Nashville, Tenn. Combined with the bicycle handles are curved levers pivoted thereto, having hooks on their shorter arms, which are received in holes formed in the under side of the cross arm, to which the handles are jointed, the invention being an improvement on a former patented invention of the same inventor.

A dumbwaiter has been patented by Mr. James Murtaugh, of New York city. It consists of two counterbalanced carriages arranged in the same shaft, one above the other, each having means for operating it independently of the other, thus making a waiter in which the upper carriage can be conveniently used for the upper and the lower carriage for the lower floors of a building.

A bag fastener and tag holder has been patented by Mr. Austin Leyden, of Atlanta, Ga. It has a plate with a hook or hooks, over which a tightened bag cord may be drawn, a plate with a slot to receive the cord, an adjustable latch bar, and other novel features, being especially adapted for use on mail bags of the second class and on bags containing general merchandise.

A feeding mechanism for grain, flour, etc., has been patented by Mr. Charles A. Andrus, of La Grange, O. It is a mechanism which secures a positive discharge from the bin, subject to regulation as to the amount of material passed out of the receptacle, and applicable to a large range of work, from the natural grain to the softest stock, which is fed so that it cannot sift or dust and waste.

An inhaling device has been patented by Mr. Marmaduke W. Hobbs, of Richmond, Ind. It is an inhaler or respirator in which an adjustable disk or valve is employed for regulating the admission of air into the instrument when in use, and for closing one of the air openings when not in use, there being shallow trays for holding the substances to be inhaled, and a removable air induction tube.

A window cleaner has been patented by Mr. Carl B. Von Schenk, of Frankfort-on-the-Main, Germany. The invention consists of a pad attached to a bracket secured to a block, with a powder holder secured to the bracket, and a detachable pad, being designed to clean and polish windows, looking glasses, etc., without the use of water, the specially described powder consisting of silicic acid, magnesia, aluminum, and sulphuret of calcium, prepared as set forth.

A piano forte damper cover has been patented by Mr. Emil Hofinghoff, of Barmen, Prussia, Germany. It is fastened to the back or to the bottom of a grand piano, and is hinged to the instrument so that it can be conveniently opened or closed by hand, and fixed to any desirable amount of opening, being designed to facilitate controlling the power and to improve the tone of the instrument, and also to guard against hurtful influences of temperature and dampness.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY IN THE SERVICE OF MAN. From the German of Dr. Alfred R. Von Urbanitzky. Edited by R. Wormell. 859 pp. London and New York: Cassell & Company.

This is a very comprehensive popular, and practical treatise on the application of electricity in modern life, referring to and describing, with numerous illustrations, a large proportion of the hitherto published experiments and investigations in nearly all branches of electrical development. Part I. treats of the principles of electrical science, and Part II. of its technology, including generation and conduction, the electric light (noticing all the different systems that have attained any degree of success), electro-chemistry and metallurgy, electricity as a motive power, the telephone and the telegraph.

STEAM ENGINE CATECHISM. Part II. By Robert Grimshaw. New York: John Wiley & Sons.

This little volume, really issued as a supplement to a former brief catechism of the same author, is a continuation of the same style of giving information in regard to steam engine practice, through the form of question and answer.

PRECIOUS STONES IN NATURE, ART, AND LITERATURE. By S. M. Burnham. Boston: Bradley Whidden.

The author has put together in this volume 400 pages of very readable matter touching precious stones and their imitations, as a sort of supplement to his former work on "Limestones and Marbles," published in 1883. The chapters relative to collections of precious stones, crown jewels, and prices, trade, pawns, etc., engraving on stones, and their secular and sacred uses, are full of interesting anecdote and detail drawn from a wide field of investigation. Nearly one hundred pages are devoted to the diamond alone, and the appendix has tables of sizes of remarkable diamonds, and the relative hardness, specific gravity, and principal constituents of precious stones. The book has a full index.

Special.

A WELL KNOWN SOCIETY LADY'S LIFE SAVED.

Mrs. Colonel Fleming, an accomplished lady, well known in Philadelphia, in Western Pennsylvania, and in Washington, has been spending a considerable time in Philadelphia, preparatory to going to Washington, where it is understood she is to have her future home. Graceful in her movements, elegant in form, and the very picture of health in her features, Mrs. Fleming would not be taken for one who had suffered a long experience of illness, and who had so completely lost her health that her friends had given up all hope of her recovery.

The writer recently met Mrs. Fleming, and had a conversation with her as to her illness and restoration.

"For many months," said Mrs. Fleming, "during the protracted illness of my husband, which resulted in his death, I was with him night and day, undergoing a very severe strain, both physically and mentally. While he lived I was able to bear up under all this, but when he died then came a reaction, and I was taken with a severe catarrhal fever. This brought me down very low. After a while I rallied, but did not recover my health. I fell into a state of nervous exhaustion, with neuralgic pains almost beyond endurance. My head was so sensitive that I could not touch it with a comb. My hands were so disabled that I could not bar my own window shutters. I had difficulty in recognizing my best friends during some of the time while I was at my worst. Day and night I suffered more than I can tell. This was at my home in Franklin, Pa. Finding that the best physicians there were unable to relieve me, I came to Philadelphia to consult physicians who were specialists in nervous diseases. Following their advice, I went to the University Hospital, where I had a private room and the most skillful medical attendance. But it was in vain. From all this I received no advantage.

"Some years ago I had heard of what was then a new remedy, but was said to do wonderful things in the cure of stubborn and chronic nervous diseases. It was 'Compound Oxygen.' I thought I could do no worse than to try it. Unable to walk even a short distance, I went in a carriage to the office of Drs. Starkey & Palen. On reaching there I was so exhausted that I was unable to state my case to Dr. Starkey. After resting, I had a full conversation with him, and he gave me encouragement to hope that Compound Oxygen might give me some relief. It was with some apprehension of possible failure that my first inhalation was taken. But as soon as I realized what it was, I was delighted with the soothing and strengthening effect of the treatment. Dr. Starkey thought that in about three weeks some permanently good result might be expected. Rooms were secured near the office, for I was too weak and nervous to go any great distance, even in a carriage. I took the Office Treatment regularly every day. In about two weeks I experienced a marked improvement, which now daily increased. My exhausted brain began to be itself again, and my body received new vitality. With improvement came hope of entire recovery. For the first time since my husband's death I found relief from the pain and prostration which had borne so heavily on me.

"With changing weather, I would sometimes receive a partial setback for a few days. But this did not discourage me. Friends of mine, in Franklin, had been cured of severe and protracted illness, and why should not I? I kept regularly on for months, not as an experiment, for I found that I was receiving solid and practical good from the treatment.

"Not a particle of any other medicine but Compound Oxygen did I take. This was doing the work for me, and I determined to give it a fair chance."

"I suppose I need hardly ask you, Mrs. Fleming, if your health is now perfectly restored?"

"I am as you see me. I have neither ache, pain, nor weakness. I sleep well, and my appetite is hearty. I am as active as I ever was, and in as good spirits, and I lay it all to Drs. Starkey & Palen's care of me, and treatment with Compound Oxygen. Without this I think I should have been dead long before this. It is now nearly two years since I began taking the Compound Oxygen. If I should ever be sick again, I will again take it; but happily I have no need of it now."

The whole story of Compound Oxygen is pleasantly told in a little brochure of 200 pages, issued by Drs. Starkey & Palen, 1529 Arch Street, Philadelphia, Pa. This will be mailed freely to all who write requesting it.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Prof. Vose, in the preface to his "Manual for Railroad Engineers," says that Trautwine's "Civil Engineer's Pocketbook" is "beyond all question the best practical manual for the engineer that has ever appeared." See also Trautwine's "Railroad Curves" and "Earthwork."

A prominent mechanical engineer makes the statement that the loss from the absence of a covering from steam pipes and boilers is astonishingly large. One square foot of *exposed surface* of engine, boiler, or steam pipe, will condense, per hour, an amount of steam equal in foot pounds to one-third of a horse power. In available work, the loss is fully one-twentieth of a horse power per hour for each sq. ft. of exposed surface. In view of these facts, it behooves every user of steam to see that all his steam-heated surfaces are properly covered with a good, durable, non-conducting covering. For the past eighteen years the H. W. Johns Mfg. Co., of this city, has made a special study of this branch of their business, and are supplying materials which, for durability and efficiency, stand superior to all others in the market.

Mechanic's Own Book. Full instructions for drawing, casting, founding, forging, soldering, carpentry, carving, polishing wood and metals, turning, roofing, etc. 702 pages; 1,420 illustrations. $2.50, post paid. E. & F. N. Spon, 35 Murray St., N. Y.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

Friction Clutches from $2.25 on. J. C. Blevney, Newark, N. J.

Protection for Watches.

Anti-magnetic shields—an absolute protection from all electric and magnetic influences. Can be applied to any watch. Experimental exhibition and explanation at "Anti-Magnetic Shield & Watch Case Co.," 18 John St., New York. F. S. Giles, Agt., or Giles Bro. & Co., Chicago, where full assortment of Anti-Magnetic Watches can be had. Send for full descriptive circular.

Complete Practical Machinist, embracing lathe work, vise work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, etc. By Joshua Rose. Illustrated by 356 engravings. Thirteenth edition, thoroughly revised and in great part rewritten. In one volume, 12mo, 439 pages. $2.50. For sale by Munn & Co., 361 Broadway, New York.

Concrete patents for sale. E. L. Ransome, S. F., Cal.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

A Catechism on the Locomotive. By M. N. Forney. With 19 plates, 227 engravings, and 600 pages. $2.50. Sent on receipt of the price by Munn & Co., 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

"For contemplation he, and valor formed,
For softness she, and sweet attractive grace."

John Milton, in his "Paradise Lost," thus distinguishes woman from man. Diseases fall to her lot that do not to man's, peculiar to her soft and more refined nature. A remedy adapted to the cure of her peculiar diseases is found in Dr. R. V. Pierce's "Favorite Prescription," for women. Thousands who have used it attest its great worth.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder*." A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Wrinkles and Recipes. Compiled from the SCIENTIFIC AMERICAN. A collection of practical suggestions, processes, and directions, for the Mechanic, Engineer, Farmer, and Housekeeper. With a Color Tempering Scale, and numerous wood engravings. Revised by Prof. Thurston and Vander Weyde, and Engineers Buel and Rose. 12mo, cloth, $2.00. For sale by Munn & Co., 361 Broadway, New York.

Cutting-off Saw and Gaining Machine, and Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Rubber Belting, all sizes, 77½ per cent regular list. All kinds of Rubber Goods at low prices. John W. Buckley, 156 South Street, New York.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co. 419 East 8th Street, New York.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Pat. Geared Scroll Chucks, with 3 pinions, sold at same prices as common chucks by Cushman Chuck Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1886 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., 112 Liberty St., New York.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 93 John St., N. Y.

Pays well on Small Investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday schools, and home amusements. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. F. P. asks if a diamond will give light in the dark. A. No; unless by phosphorescence after exposure to sunlight or the electric arc light.

(2) B. D. asks how to preserve some mole skins without injuring the fur—an easy method. A. Supposing the skins are dry, they should be softened throughout by soaking in pure water; soft water is best, but any ordinarily pure water may be used, and care must be taken that the skins are thus soaked only a sufficient time to soften them. Then clean off any bits of flesh that may remain on the flesh side, rinse all well,

© 1886 SCIENTIFIC AMERICAN, INC

shake off the loose water, and gently stretch out and tack on a board, flesh side up. Then sprinkle with a mixture of powdered alum and salt, about two-thirds alum and one-third salt, enough to just cover every part. As the skin dries it takes up the mixture, but if any be left on the surface the second day, sprinkle on a little more water, otherwise put on more alum and salt, and sprinkle. Two to three days should be sufficient for such small skins, the idea being to give the skin all of the alum and salt it will take up, while in a moist condition. This tawing process makes the hair firm, a gentle rubbing and beating softens the flesh side, and it is preserved from decay, although tawed skins are never calculated to stand much wetting. This process is well adapted for all small skins, although those which are heavier require more time, and the flesh sides are sometimes folded together, and the skins rolled up. When the skins are freshly taken off, no soaking is needed, but more care is then called for in thoroughly washing off and cleaning them, and the first application of salt and alum should be in the proportions of one-half each. It requires the judgment of a tanner to deal with skins in a dry state which may have become partly damaged before drying, and it requires special knowledge also to tell whether a dry skin is so damaged.

(3) **A. T. G.** asks what is the process of fastening rubber rolls on clothes wringer. A. Clean shaft thoroughly between the shoulders or washers, where the rubber goes on. 2. Give the shaft a coat of copal varnish, between the shoulders, and let it dry. 3. Give shaft coat of varnish and wind shaft tightly as possible with five ply jute twine at once, while varnish is green, and let it dry for about six hours. 4. Give shaft over the twine a coat of rubber cement, and let it dry for about six hours. 5. Give shaft over the twine a second coat of rubber cement, and let it dry for about six hours. 6. Remove washer on the short end of shaft, also the cogwheel if the shaft has cogs on both ends. 7. See that the rubber rolls are always longer than the space between the washers where the rubber goes on, as they shrink or take up a little in putting on the shaft. 8. Clean out the hole or inside of roll with benzine, using a small brush or swab. 9. Put the thimble or pointer on the end of shaft that the washer has been removed from, and give shaft over the twine and thimble another coat of cement, and stand same upright in a vise. 10. Give the inside or hole of roll a coat of cement with a small rod or stick. 11. Pull or force the roll on the shaft as quickly as possible with a jerk, then rivet the washer on with a cold chisel. 12. Let roll stand and get dry for two or three days before using same. Cement for use should be so thick that it will run freely; if it gets too thick, thin it with benzine or naphtha.

(4) **W. H. H.** asks the best known receipt for purifying the best sweet oil sufficiently for watch oil. A. Put thin sheet lead into olive oil in a bottle, expose it to the sun for a few weeks, and pour off the clear liquid.

(5) **J. R. S.** asks (1) the composition of a cheap paint suitable for rough work. A. Grind powdered charcoal, oxide of iron, or any convenient pigment in linseed oil with sufficient litharge as drier, and thin for use with well boiled linseed oil. You will find it, however, cheaper to purchase a ready made paint from some reputable dealer. 2. A good work on the manufacture of paper from wood. A. See "Technology of Paper Trade," in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 109, 110, 116, 117, 118, and 123.

(6) **A. R. H.** asks the receipt for making the Sozodont tooth powder. A. Take of potassium carbonate ½ ounce, honey 4 ounces, alcohol 2 ounces, water 10 ounces, oil wintergreen and oil rose sufficient to flavor. 2. A good stove polish. A. Take of black lead pulverized 1 pound, turpentine 1 gill, water 1 gill, sugar 1 ounce.

(7) **S. G.** asks: Is there any way to mark white dishes permanently? A. We know of no means except by grinding suitable pigments in proper vehicle, painting the china, and then burning it in.

(8) **L. S. B.** desires a receipt for making a good black lacquer. A. Take of burnt umber 8 ounces, true asphaltum 3 or 4 ounces, boiled linseed oil 1 gallon; grind the umber with a little of the oil; add it to the asphaltum, previously dissolved in a small quantity of the oil by heat; mix, add the remainder of the oil, boil, cool, and thin with a sufficient quantity of oil of turpentine.

(9) **D. W. McD.** asks how to restore rancid butter so that it will taste and smell well. A. Wash well first with some good new milk, and next with cold spring water.

(10) **A. H. W.** writes: I want to have twelve triangles made from bar steel, each one to be of a different tone from the other. What sizes should each be, and what sizes of steel should each be made of, to make the best sounds? A. As you cannot depend upon getting steel of small and exact variations in size, your only course is to make a trial of a bar, and make a second trial with a shorter bar for the next note. Then make a trial on the next size steel. Commercial steel varies enough from its normal size to prevent any computation of lengths for chimes or chords or single notes.

(11) **W. H. R.** asks: 1. How can I construct a simple hygrometer to ascertain the moisture of a room when steam vapor is used? A. You may make a very good hygrometer by hanging a piece of well twisted catgut, that has not been oiled, to a hook with a disk or pointer attached to the lower end just heavy enough to straighten the catgut, using an eye of wire to keep it from swinging. The whole may be fastened to a small strip of wood, to hang upon the wall. The catgut may be a few inches or a foot or two long, according to the amount of twist. The index will swing with the hygrometric changes, and may be adjusted to proportional parts by comparison with a "Mason's hygrometer." SUPPLEMENTS 571, 334, 14, 379, 155. 2. Give me the best recipe you can for a casehardening compound, to be used on open fires. A. Casehardening in the open fire is a very poor and superficial process. We know of nothing better than a mixture of cyanide of potassium and hoof shavings thoroughly pulverized and mixed. 3. What is the best welding compound for working steel? A. There are a great many welding compounds in use, with as many claims to superiority. We have found nothing better than borax with a little sal ammoniac—about 10 per cent—all pulverized together.

(12) **O. A. B.** asks for a preparation or composition used to bleach hair. A. Use hydrogen peroxide, a description of which and its method of manufacture is given in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 184 and 239. Wash the hair thoroughly, and when perfectly dry, apply the bleach with a small sponge, rubbing well into the roots of the hair. Use as often as may be necessary to obtain the desired shade.

(13) **J. T. C.** asks (1) a receipt to bleach sponges. A. Soak in diluted muriatic acid 10 or 12 hours, then wash with water and immerse in a solution of hyposulphite of soda to which a small quantity of diluted muriatic acid has been added, and wash out. 2. How to kill ringworm or barber's itch? A. Wash the part affected with a little lemon juice; then rub in with the finger a little gunpowder which has been bruised in a porcelain mortar. Do this gently about twice a day. Be very careful not to make the skin sore. 3. A good receipt for hair dye? A. Take of silver nitrate 1 ounce, copper nitrate 1 drachm, distilled water 2 ounces. Dissolve the salts in the water, and add water of ammonia to the solution until the liquid becomes of a clear blue color.

(14) **M. A. M.** writes: I wish to preserve a portion of a polished steel surface and etch or eat away the remainder to a depth sufficient to re eive a thick electro plate of silver, so that when plated, and the plating polished, it will be even with the preserved steel surface, so the whole surface will be even, but a portion steel and a portion silver plated. A. This is what is called electro inlaying, and is only successfully practiced by experts in this style of art. The etching process is the same as for engraving steel plates. The protecting material is asphalt varnish, which may be used with pencil brushes for ornamental work or for stopping off any parts not required to be acted upon by the acid. Asphalt, resin, and beeswax about equal parts, varied for hardness to suit the temperature, is suitable to cover the surface, warmed by dabbing with a small pad. This allows of the figure being scratched in with a point. Nitric acid 1 part, water 2 to 4 parts, is generally used for biting in the figures. This, followed by a dilute muriatic acid dip for removing oxide and cleaning the surface, will probably prepare the piece for electro plating. If not, you will have to make a study of chemicals that will clear the surface so as to take the silver; possibly a few trials cyanide of silver or potasso-cyanide may give you success. For electroplating, see details in SUPPLEMENT, No. 310.

(15) **F. S. S.** asks whether the last drops of a liquid dropped from a bottle are larger than the first, and why? A. The size of drops depends on the shape of the surface on which they form and on the rapidity of delivery. Hence they may be either larger or smaller when a bottle is nearly empty than when it is full, generally we think larger, because the flat surface of the mouth or lip is then the forming surface.

(16) **J. G.** asks (1) how to make a good cheap varnish for furniture. A. Melt 120 parts of yellow wax and a little pulverized resin, and compound this with 60 parts of warm oil of turpentine or spirits of turpentine. Rub the furniture with this by means of a woolen rag. 2. A receipt for cleaning window glass. A. Tie up some finely powdered whiting in a small piece of muslin. Dab it over the glass thoronghly. The dirtier the glass, the more whiting will adhere to it. Next smear it evenly with a damp rag, and let it remain until perfectly dry; then rub it off with a leather.

(17) **W. G. S.** asks: How is the bisulphide of tin amalgam prepared for frictional electric machines? A. It is not an amalgam. Powdered bisulphide of tin is spread over the greased cushions. An amalgam of one part of zinc, one of tin, and two of mercury is highly recommended.

(18) **Lux** asks: Is there any solution in which I can soak paper to make it a conductor of electricity when dry, also a method of putting an electrically conductive surface on paper? A. The electrically conducting solutions depend generally on the moisture they retain for their efficacy. For a surface, Dutch leaf or some metallic bronze powder is available.

(19) **F. H.** asks: 1. Will the micro-telephone, Fig. 5, described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 163, work on telephone described in SUPPLEMENT, No. 142, where no battery is used? A. The micro-telephone requires a battery. 2. Can a telephone made with permanent magnet be used with battery? A. It can. 3. Will it do to make bobbins of permanet magnet telephone of metal instead of wood? A. Metal is quite objectionable, as tending to shield or mask the current effects. Use wood or ebonite.

(20) **E. B.** asks: 1. Could water be heated to a temperature of twelve hundred degrees, that is, could a boiler be constructed strong enough, and a fire of ordinary coal be made hot enough to produce a temperature of twelve hundred degrees, no steam to be used, but simply to see how hot the water could be made? A. Water could be heated to any temperature short of dissociation. No boiler and fire could be constructed that would stand the pressure. 2. What would be the pressure per square inch on the boiler in above question? A. The pressure would be enormous. If steam space existed, it would be in the neighborhood of three hundred thousand pounds to the square inch (by Weisbach's formula). If it were solid water, the pressure would be still greater. 3. Would a tuning fork vibrate as long under an air pressure of ten atmospheres as it would under a pressure of one atmosphere? A. A tuning fork would vibrate longer in a vacuum than in air, and longer in one atmosphere than in ten.

(21) **D. A. B.** asks a receipt for dissolving mica, such as is used in stoves? A. Mica cannot be dissolved without complete decomposition. 2. In what way is rubber polished after vulcanizing, in the manufacture of combs and other rubber goods? A. By the ordinary finest grade of polishing powders, such as glass flour, emery, or rotten stone, and the use of cloth buffs or hand appliances to do the work. 3. Is there any method of preparation that can be used for coating plaster of Paris models that will leave the rubber smooth and bright after vulcanizing? A. Oil and blacklead and soapstone powder are recommended as facing for moulds. The SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, 252, which we can send you for tencents apiece, treat the subject exhaustively, more especially the last number.

(22) **B. F. R.** asks: Can you add any harmless substance to milk that would make a copious and permanent foam on being beaten with an egg beater? A. You might take the following, which is used with soda water: To each gallon add from two to four ounces of gum arabic dissolved in its own weight of water; or use the following: Quillaya bark 4 ounces, alcohol 4 ounces, glycerine 4 ounces, and water 8 ounces. Exhaust by percolation to make 1 pint of tincture. Two to five drachms of this tincture to be used to every gallon of fluid.

(23) **G. F.** asks why the planet Mercury is so much more flattened at the poles than the earth. A. There is no flattening of the poles of Mercury that has ever been measured, except at its transits, and then it is not observable in common telescopes. What you have probably seen is the gibbous phase due to its position in relation to the sun and earth. This might appear like an extreme flattening in a poor telescope.

(24) **C. R. B.** writes: I intend to make a dynamo three times larger than the one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, and wish to know its capacity in furnishing a current for incandescent lamps (without battery). How many lamps of 20 candle power will it run, how many lamps of 24 candle power will it run, and how many lamps of 32 candle power will it run? Also please quote the additional lamps of 20, 24, and 32 candle power it will run with 6 medium sized Bunsen cells additional? A. A dynamo three times the size of that described in SUPPLEMENT, No. 161, would probably not run more than two or three 20 candle lamps. The six Bunsen cells would help it a little if used to charge the field. We do not recommend this dynamo for practical, every day use. We hope soon to describe a larger dynamo.

(25) **B. L. R.** asks how the ribbons used on writing machines, daters, etc., are made, that is, what material is used for making the different colors, how they are compounded, and how the ribbons are prepared. A. Take yaseline (petrolatum) of high boiling point, melt it on a water bath or slow fire, and incorporate by constant stirring as much lampblack or powdered drop black as it will take up without becoming granular. If the fat remains in excess, the print is liable to have a greasy outline; if the color is in excess, the print will not be clear. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum, benzine, and rectified oil of turpentine, in which dissolve the fatty ink, introduced in small portions by constant agitation. The volatile solvents should be in such quantity that the fluid ink is of the consistence of fresh oil paint. One secret of success lies in the proper application of the ink to the ribbon. Wind the ribbon on a piece of cardboard, spread on a table several layers of newspaper, then unwind the ribbon in such lengths as may be most convenient, and lay it flat on the paper. Apply the ink, after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a tooth brush. Hardly any ink should remain visible on the surface. For colored inks, use Prussian blue, red lead, etc.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

December 7, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Aerated water fountain, J. C. Johnson 353,862
Air and gas for delivering the mixture to carburetors, apparatus for mixing, R. S. Lawrence .. 354,067
Air brake, A. G. Easton 354,014
Alarm. See Fire alarm.
Album stand, F. Seipelt 353,763
Almond huller, J. Hobart 353,857
Almond paste, machine for rolling, M. E. Thieme 353,765
Animal releasing device, J. Pehrs 354,093
Animal trap, J. Bean 353,657
Artery ligator, J. Trulinger 354,029
Astrakhan warp threads, machine for preparing, T. Harrison 353,988
Bag. See Feed bag. Shipping bag.
Baking sugar wafer cakes, etc., machine for, G. S. Baker 353,787
Bar. See Harvester cutter bar. Pinch bar.
Battery. See Voltaic battery.
Bearing for shafts and axles, roller, J. Gibbons (r) 10,787
Bed, folding cot, Herrinton & Russell 353,943
Bell, call, H. A. Dierkes 353,848
Bell, letter box, M. W. Ator 354,032
Belting, machine, G. Meacom 353,873
Bicycle, E. L. Winey 353,904
Blacking box, handled, I. H. White 353,725
Blacking case, E. R. Roehm 353,969
Blacksmith's furnace, H. D. King 353,686
Blinds, fixture for sliding, W. H. Holbrook 353,858
Block. See Pillow block.
Bobbin reamer, S. C. Ketchum 353,864
Boiler. See Steam boiler.
Boiler cleaner, I. T. Hardy 354,016
Boiler furnace, J. Ham 354,057
Bolt. See Flour bolt.
Bolt dressing machine, W. E. Ward 353,902
Bone, ebony, marble, etc., making artificial, L. R. Mestaniz 353,697
Book case, revolving, G. V. Nauerth 353,958
Boot or shoe, C. A. Erdman 353,740
Boot or shoe burnishing machine, E. M. Parkhurst 353,756
Boot pattern, G. L. Myers 353,753
Boots or shoes, heel protector for, E. Kempshall .. 354,064
Boring machine, J. Swan 354,073
Bottle, alarm, Parsil & Trowbridge 353,807
Bottle capsule, W. Lawson 353,751
Bottles, etc., machine for automatically soaking, brushing, and rinsing, W. W. Horner 354,061
Box. See Blacking box. Draw box.
Boxes, securing covers on, C. & E. H. Morgan 353,801
Bracket. See Scaffold bracket. Sink bracket.
Brake. See Air brake. Car brake. Carriage brake. Power brake. Wagon brake.
Brooder, E. S. Renwick 353,968
Broom holder, H. P. Spencer 353,716
Buckle, T. O. Potter 353,810
Buckle, shoe, E. H. Alcott 353,912
Buckle suspender, T. O. Potter 353,812
Bung, fermenting, T. S. Glaister 353,854
Burner. See Lamp burner. Vapor burner.
Bustle, E. T. Phillips 353,881
Bustles, machinery for forming wire, H. F. Eaton 353,928
Button attaching machine, J. Lamoreaux 353,791
Button fastener, H. A. Church 353,921
Button, lever, R. H. Lewis 353,968
Button or stud, L. P. Conrad 353,778
Button setting instrument, F. H. Richards, 353,818 to 353,820
Buttons, machine for making shoe, F. H. Hardman 353,677
Cabinet and show case, combined, L. Wormser 353,770
Cable grip, roller, G. A. Polhemeus 353,809
Cable gripping device, J. Hellings 353,941
Canning fruits, meats, etc., apparatus for, Ackerman & Wagner 353,911
Camera stand, J. J. Higgins 353,856
Can making machine, E. J. Dolan 353,737
Car brake, A. Dieu 353,782
Car brake, air, J. B. Gathright 353,673
Car brake, automatic, J. B. Gathright 353,672
Car brake, electro-magnetic, H. S. Park 353,880
Car coupling, Baker & Prescott 353,838
Car coupling, H. A. Barnard 353,773
Car coupling, N. Barr 354,008
Car coupling, W. H. Burkholder 354,041
Car coupling, J. B. Nixon 353,804
Car coupling, C. E. Seabury 353,826
Car coupling, E. G. Sessions 353,974
Car coupling, S. Shull 353,977
Car platforms, safety gate for, E. L. Tevis 353,898
Car, railway, Riordan & Martyn 353,884
Car signal, S. Forman 353,785
Car starter, B. C. Pole 353,759
Car, stock, G. A. Smith 353,982
Car, stock, Smith & Van Orman 353,983
Car, street, W. H. Nelson 353,578
Car, street railway, J. C. Brown 354,037
Car wheel, L. R. Brooks 353,918
Cars, automatic brake for railway, H. K. Whitner 354,077
Cars by electricity, system of lighting, J. H. Marshall 353,797
Cars, heating apparatus for railway, W. C. Baker .. 353,839
Cards, etc., suspension device for express, C. G. Pfingsten 354,071
Carpets and chenille weft therefor, manufacturing imitation Turkey, Kohn & Watzlawik 353,869
Carriage brake, C. E. Luburg 353,879
Carriage spring, Sliter & Bazzett 353,980
Carriage top, shifting, F. S. Brand 353,730
Carriage wheel, C. Coolidge 353,779
Case. See Blacking case. Book case. Music case. Watch case.
Casting type, mould for, C. Hochstadt *et al* 353,060
Chain, J. E. Crook 354,046
Chair. See Tilting and rocking chair.
Chairs, spring attachment for, M. D. & T. A. Connolly 354,044
Chuck, lathe, J. H. Curry 353,736
Churn, test, J. K. Komp 354,065
Cigar machine, J. R. Williams 353,907
Cigarette bundling machine, Kinney & Butler 353,866
Cigarette machine, F. Hipgrave 353,945
Clamp, J. G. Wilber 353,726
Clasp. See Hitching strap clasp. Suspender clasp.
Cleaner. See Boiler cleaner.
Cloak, gossamer, B. & T. E. Goodrich 353,743
Cloak, gossamer, M. J. McCarthy 353,954
Clock for transmitting signals, electric, J. S. Bailey 353,840
Clod crusher and land roller, combined, G. N. Lake 353,952
Cock, self-acting gas, G. Nobes 354,021
Cock, stop, C. J. Mortimer 353,802
Coffee pot, Wilson & Coe 353,909
Coffin, Breed & Ober 353,916
Coffin, metallic, S. E. Baker 353,772
Collar coupling, breast, G. A. St. John 354,028
Collar, horse, J. L. Campbell 353,732
Collars, sweat pad for horse, S. Barstow 353,913
Conduit or other pipe, D. N. Hurlbut 353,680
Conduits or pipes, die for forming, D. N. Hurlbut. 353,681
Copying of pictures, apparatus for facilitating, E. Charman 353,919
Cord and rope holder, O. Crocker 353,925
Corkscrew, C. H. Hudson 353,860
Corn sheller, C. Roberts 353,885
Cotton press, A. B. Flowers 353,784
Coupling. See Car coupling. Collar coupling. Thill coupling.
Crusher. See Clod crusher.
Cultivator, L. Foster 353,742
Cultivator, E. Patterson 353,707
Cultivator, Woodruff & Wagner 354,003
Direct-acting engine, C. C. Worthington 354,030
Distilling wood, process of and apparatus for, T. W. Wheeler 353,998
Door for jails or prisons, W. H. Brown 353,562
Doors and blinds, hanger for, H. Hinckley 353,788
Doors, means for fastening screen cloth to, C. Whitaker 353,724
Draught door and check draught, D. E. Paris 353,964
Draught hook for vehicles, G. Heon 353,942
Draw box, H. M. & R. S. Goodman 354,056
Easel, artist's, J. W. Turner 352,719
Electric igniting machine, dynamo, H. J. Smith ... 353,827
Electric machine regulator, dynamo, E. A. Sperry, 353,986, 353,988
Electric machines, annular armature for dynamo, E. A. Sperry 353,989
Electric motor, E. A. Sperry 353,987
Electric regulator, E. A. Sperry 353,990

© 1886 SCIENTIFIC AMERICAN, INC

Electrical conductors, coupling for, W. F. Smith.. 353,984
Electrical testing, C. S. Bradley..... 353,915
Elevator. See Hydraulic elevator.
Engine. See Direct-acting engine.
Engine reversing mechanism, L. C. Forwood.... 353,850
Envelope, C. Gulath..... 354,080
Envelope machines, endless apron for, F. H. Richards..... 353,816
Envelope, etc., safety, J. E. Krucker..... 354,066
Extracts from fish, making, C. A. Sahlstrom..... 353,822
Fabric. See Woven fabric.
Fan apparatus, rotary, J. S. Walker *et al*..... 353,994
Fan, rotary, E. H. Johnson..... 354,063
Farm gate, E. H. & A. E. Adams..... 354,005
Faucet, force and drain, A. J. & E. H. Weatherhead..... 353,723
Feed bag for animals, Dyer & Monfort..... 354,050
Feed regulator boiler, C. O. Wyman..... 354,078
Feeder for steam boilers, automatic water, C. O. Rabut..... 353,882
Fence, S. Collins..... 353,665
Fence, A. Fay..... 353,741
Fence, G. W. Holmes..... 353,859
Fence, King & Highfield..... 353,950
Fence, R. L. Whittington..... 353,908
File, paper, J. C. Lang..... 353,953
Filter, J. P. Gruber..... 353,855
Fire alarm, B. J. Antrim..... 354,006
Fire bucket, J. Chivill..... 353,733
Fire extinguishing apparatus, automatic, Thompson & Ritchie..... 353,766
Fish trap, T. Thompson..... 353,767
Flour bolt, O. M. Morse..... 353,698
Fluids in definite proportions, commingling flowing, L. H. Nash..... 353,704
Fluids in definite proportions, device for commingling flowing, L. H. Nash..... 353,705
Flush tank, J. Wilson..... 354,000
Folding table, E. E. Conwell..... 353,923
Fountain. See Aerated water fountain.
Fruit jar, G. Darracott..... 353,926
Furnace. See Blacksmith's furnace. Boiler furnace. Locomotive furnace.
Furnace grate, H. Lencke..... 353,689
Gauge. See Track gauge. Water gauge.
Gas, air mixer for, J. L. Brown..... 353,848
Gas meter register, J. Deutschbein..... 353,781
Gas regulator, J. H. Helm..... 354,017
Gate. See Farm gate.
Gate, S. L. Ingham..... 352,682
Generator. See Steam generator.
Glass, cement for use in manufacturing stained, R. McKee..... 353,695
Glove fastener, W. R. Comings..... 353,845
Glue from marine animals, obtaining, C. A. Sahlstrom..... 353,824
Governor, steam engine, Bancroft & Lewis..... 354,033
Governor, steam engine, Miller & Frey..... 353,957
Grain grader, M. D. Beardslee..... 353,658
Grain products, preparing, G. H. Cormack..... 353,924
Grate, H. W. Merritt..... 353,875
Grinding mill, G. & A. Raymond..... 353,710
Grinding mill, roller, J. B. Alifree..... 354,051
Guard. See Railway foot guard.
Gun, magazine, M. E. Gregg..... 353,676
Gun, magazine, L. L. Hepburn..... 354,059
Gun sight, F. E. Halladay..... 353,786
Handle. See Sad iron handle.
Harness, W. Olewine..... 353,879
Harrow, A. B. Clippinger..... 353,734
Harrow, W. Hill..... 353,944
Harvester cutter bar, J. H. Van De Water..... 353,899
Harvester for sugar cane, corn, etc., S. H. Pearcy 353,758
Hat, campaign, F. M. Mahan..... 353,693
Hats, ventilating, H. C. Zerffi..... 354,004
Hatchway, C. Lagerquist..... 353,951
Hay rake, horse, H. McPherson..... 353,799
Hinge, gate, D. J. Olinger..... 353,962
Hinge, spring, W. Gilfillan..... 353,853
Hitching strap clasp, C. B. Bristol..... 353,842
Holder. See Broom holder. Cord and rope holder.
Hook. See Draught hook. Snap hook.
Horse power, G. & A. Raymond..... 353,967
Horses, foot rasp for, A. P. Williams..... 353,999
Hub and general boring and mortising machine, A. L. Navone..... 353,877
Hub cap, J. Rapp..... 353,709
Huller. See Almond huller.
Hydrant and fire plug, H. E. Earle..... 353,739
Hydraulic elevator, N. P. Otis..... 354,070
Incubators, heat regulator for, H. Killam..... 353,865
Intestines, machine for cleaning, J. Cunning..... 354,047
Iron. See Sad iron.
Ironing machine, L. H. Watson..... 353,769
Jacket for children, H. Maltby..... 353,796
Jar. See Fruit jar.
Joint. See Railway rail joint.
Knapsacks, means for carrying, A. Mendel..... 353,874
Ladder, combination, C. Koerner..... 353,868
Ladder, extension, M. C. Walls..... 353,722
Lamp, Z. Davis..... 354,048
Lamp, E. L. Winey..... 353,905
Lamp brackets, etc., clamp for, H. J. Meunier..... 353,956
Lamp burner, A. Geiss..... 353,674
Lamp, car, W. H. Briggs..... 353,661
Lamp, incandescent electric, T. A. Edison..... 353,783
Land roller, Horey & Marsh..... 353,769
Lathe, car wheel and axle, K. Rasmussen..... 353,814
Lathes, driving dog for turning, K. Rasmussen.... 353,815
Lemon squeezer, R. Onderdonk..... 354,022
Level, spirit, G. Cook..... 353,846
Level, spirit, E. E. Webb..... 354,076
Lock. See Turret lock.
Locomotive furnace, J. B. Barnes..... 354,007
Locomotive traction increaser, H. F. Shaw..... 353,714
Loom for weaving pile fabrics, T. Harrison..... 353,937
Loom shuttle, McGee & McMahon..... 353,872
Lubricator, Evans & Cordner..... 353,671
Marble, composition for use in the manufacture of artificial, C. Straub..... 353,896
Mattress, leak stopping, J. H. L. Tuck..... 353,718
Measure, tape, J. Fountain..... 353,851
Mechanical movement, F. H. Richards..... 353,760
Mechanical movement, J. S. Swan..... 354,074
Meter. See Water meter.
Mill. See Grinding mill. Sawmill. Windmill.
Moulding machine, sand, A. Rice..... 353,712
Moulding machine, sand, S. P. M. Tasker..... 353,832
Mouldings, machine for buffing, W. & J. Schmitt.. 353,972
Motor. See Electric motor. Weight motor.
Mower, W. Van Wyck..... 353,993
Mowing machine knives, machine for grinding, W. S. Williams..... 353,908
Music case, N. Lochbaum..... 353,794
Musical instruments, pneumatic action for, F. Stone..... 253,894
Nail holding receptacle, Spath & Remick..... 353,985
Nailing machine, A. Eppler, Jr..... 354,052
Needle, J. K. Krieg..... 354,018
Numbering machine, consecutive, J. H. Reinhardt..... 353,711
Nut blanks, machine for forming, W. E. Ward.... 353,901
Nuts, manufacture of blanks for hexagonal, F. A. Hasenclever (r)..... 10,788
Oil cloth, making stair and table, A. F. Buchanan. 353,777
Oil from marine animals, extracting, C. A. Sahlstrom..... 353,823
Ore feeder, G. E. Woodbury..... 353,727
Organ coupler, F. Stone..... 353,895
Orthopedical appliance, I. Zacharie..... 353,910
Pad. See Truss pad.
Paper pulp digester, C. Bremaker..... 353,731
Paper, watermarked, Z. Crane, Jr..... 353,666
Papeterie and writing desk, S. Berge..... 353,774
Pattern. See Boot pattern.
Pencil sharpener M. Rush..... 353,761
Phosphates from slags, manufacture of, C. Scheibler..... 353,825
Photographic print washer, W. G. Entrekin..... 353,849
Pillow block, E. S. Newton..... 353,960
Pinch bar, W. Franklin..... 354,053
Pipes, boilers, etc., covering for, H. M. Small..... 353,981
Piston meters, register connection for, L. H. Nash..... 353,805
Planter, corn, N. O. Starks..... 354,025
Planter, corn, E. Tyden..... 353,834
Planter and cultivator, combined corn, J. C. Weiss..... 353,835
Planter and fertilizer distributer, seed, W. B. Simpson..... 353,979
Planter, seed, G. F. Johnson..... 353,949
Planter, sulky corn, W. Newhall..... 353,959
Plow, W. Deuel..... 353,668
Plow, W. A. Fretwell..... 353,852
Plow, J. E. W. & C. W. Smith..... 353,828
Plow, swivel, F. C. Merrill..... 353,696
Pot. See Coffee pot.
Power. See Horse power.
Power brake, R. Solano..... 353,892
Press. See Cotton press.
Printing lumber, machine for, L. Roth..... 353,762
Printing machine, hand roller, J. H. Eiermann.... 353,670
Printing machine inking apparatus, H. Lee..... 353,792
Printing machine with addressing attachment, C. H. Hanchett..... 353,787
Printing presses, etc., alarm counter for, J. Ruesch..... 354,024
Puller. See Stump puller.
Pulverizer, H. S. Howard..... 353,947
Pulverizer, E. J. Schuman..... 353,973
Pump, L. Teague..... 352,897
Pump valve, P. L. Weimer..... 353,997
Pumps, governor for circulator, W. H. Brooks.... 353,776
Punch, F. H. Richards..... 353,817
Quilting machine, I. Deutsch..... 354,049
Rack or stand for holding manuscript or other matter to be copied, S. B. Costen..... 354,045
Radiators, loop pipe for, G. W. Walker..... 353,900
Railway appliance, J. E. Nathan..... 353,754
Railway cross tie, S. D. Locke..... 353,691
Railway foot guard, J. B. Atwood..... 353,771
Railway rail joint, W. F. Gould..... 353,675
Railway switch, C. M. Crosby..... 353,847
Railway switch, J. F. Penrod..... 353,708
Railway switch stand and switch connection, T. E. Calvert..... 353,664
Railways, grip for cable, C. Scholz..... 353,713
Rake. See Hay rake.
Rakes, making, A. D. Myers..... 353,803
Range, J. Mander..... 353,871
Reflector attachment for lanterns, J. Hirth..... 353,678
Register. See Gas meter register.
Regulator. See Electric regulator. Electric machine regulator. Feed regulator. Gas regulator.
Rein muff, S. J. Hull..... 353,861
Revolver, J. Boland..... 353,914
Revolver, J. C. Howe..... 353,948
Robe, lap, T. Hawley..... 353,939
Rocking chair attachment, W. I. Bunker...354,038, 354,040
Rocking chair spring, W. I. Bunker..... 354,039
Rocking chair spring attachment, M. D. & T. A. Connolly..... 354,043
Roller. See Land roller.
Rotary sprinkler, I. W. McGaffey..... 353,955
Sad iron, M. J. Shimer..... 353,976
Sad iron handle, J. F. Bless..... 353,660
Saddle harness, A. L. Liston..... 354,690
Sawdust and other material by centrifugal action, apparatus for washing and separating, J. V. V. Booraem..... 353,775
Sawdust and production of gas, automatic apparatus for carbonizing, E. W. Rathbun..... 353,966
Sawmill, band, W. H. Dodge..... 353,669
Sawmill set works, A. E. Roe..... 353,886
Saw plant, portable rail, W. L. Clements..... 353,922
Saws, device for jointing the teeth of, G. S. Blach 353,659
Scaffold bracket, M. E. Trafton..... 353,768
Scraper and snow plow, rail, E. B. Durfee..... 353,738
Scraper, flexible, A. J. Kaelin..... 353,863
Seal, lead, F. W. Brooks..... 354,036
Seaming machine, roof, Holt & Aldrich..... 353,946
Seat fastener, J. H. Giesey..... 354,015
Sewing machine, W. Walker..... 353,720
Sewing machine, pocket, S. A. Rosenthal..... 353,970
Sewing machines, device for controlling the driving wheels of, D. W. Goodell..... 354,055
Sheller. See Corn sheller.
Shipping bag, safety, G. H. Magee..... 353,692
Shirt, G. A. Gane..... 353,934
Shirt, W. A. Harder..... 353,746
Shoe soles to uppers, uniting, Eppler, Jr., & Cole.. 354,051
Shutter, window, L. G. Comparet..... 353,735
Sign, G. H. Kitchen..... 353,867
Signal. See Car signal.
Sink bracket, F. Taylor..... 353,991
Skelp bending machine, Pierce & Sandford..... 353,808
Smoking and drying apparatus, C. L. Ryan..... 354,072
Snap hook, C. H. Smith..... 353,889 to 353,891
Sole and heel nailing machine, F. F. Raymond, 2d 353,883
Sole channeling machine, H. H. Cummings..... 353,012
Spinning machine, W. E. Sharples..... 353,887
Spring. See carriage spring. Rocking chair spring.
Sprinkler. See Rotary sprinkler. Street sprinkler.
Square for bookbinders' use, T. Statter & Hauser. 354,026
Stand. See Album stand. Camera stand. Railway switch stand.
Steam boiler, E. D. More..... 353,752
Steam generator, W. P. Crater..... 353,667
Steam generator, J. Walp..... 353,996
Stopper. See Vessel leak stopper.
Stove, heating, J. Bierley..... 354,009
Stove or range, cooking, J. S. Van Buren..... 353,992
Stove, regenerative hot blast, J. M. Hartman..... 353,747
Stove top, oil, C. W. McCutchen..... 353,798
Street sprinkler, J. A. Bancroft..... 353,729
Street sweeping machine, C. Christoph..... 354,011
Stud and magnifying glass, combined shirt, J. F. Leighton..... 353,868
Stump puller, L. B. Gibson..... 354,054
Suspender clasp, T. O. Potter..... 353,813
Suspenders, T. O. Potter..... 353,811
Suspenders, fastening device for, G. W. Stewart.. 353,893
Switch. See Railway switch.
Table. See Folding table.
Tank. See Flush tank.
Telegraph instrument, printing, A. Wirisching.... 354,001
Telegraph, railway, E. B. Ives..... 354,789
Telegraph transmitter, J. W. Shryock..... 353,715
Telephone, N. F. Palmer..... 353,755
Telephone apparatus for divers, H. V. Hayes..... 353,940
Telephone transmitter, J. W. McDonough..... 353,694
Telephones, conductor for mechanical, J. S. Jones..... 353,683, 353,684
Tether, J. H. Kirby..... 353,750
Thill coupling, P. J. Baumgartner..... 353,656
Tie. See See Railway cross tie.
Tile, H. A. Daniels..... 353,780
Tilting or rocking chair, M. D. & T. A. Connolly... 354,042
Tobacco bag fastener, F. E. Heinig..... 353,748
Tobacco stripping and booking machine, G. Rowden..... 353,971
Tongue support, Winnek & Brown..... 353,906
Torpedo service, marine, C. S. Aylesworth..... 353,728
Track gauge and level, J. L. Barnett..... 353,655
Trap. See Animal trap. Fish trap. Waste pipe trap.
Tricyle, Lloyd & Priest..... 353,793
Trunk, wardrobe, Meurer & Klein..... 353,876
Truss, B. Bannister..... 354,064
Truss pad, B. Bannister..... 353,035
Turret lock, F. H. Richards..... 353,821
Twist drills, machine for making, S. Moore..... 354,069
Type writing machine, J. W. Peck..... 353,985
Umbrella, U. G. Steinmentz..... 354,027
Umbrella or parasol tie, J. T. Smith..... 353,764
Umbrella, parasol, or sunshade, T. Bierley..... 353,841
Umbrella runner, J. H. Simpson..... 353,978
Undergarment, R. H. Paine..... 353,963
Valve, air, J. S. Walker *et al*..... 353,995
Valve for hydraulic elevators, P. F. Morey..... 354,020
Valve, sewer pipe back pressure, W. H. Simpkins. 353,888
Valve, straight way, E. Lunkenheimer..... 354,019
Vapor burner, Armour & Bielefeld..... 353,654
Vapor burner, Z. Davis..... 353,927
Vehicle wheel, F. W. Starr..... 353,831
Vehicles, electrical propulsion of, F. J. Sprague.. 353,829
Velocipede, R. G. Britton..... 353,917
Velocipede, Gibbons & Meneely..... 353,935
Vessels, leak stopper for, I. Meisler..... 353,800
Vessels, side and deck light for, W. H. Douglas... 354,013
Voltaic battery, A. F. W. Partz..... 353,757
Wagon brake, Keever & Remy..... 353,685
Wagon standard, L. L. Welsh..... 353,836
Wagon wheel, A. C. Hall..... 353,744
Wall paper, shades, etc., rack for holding and exhibiting, W. H. Hazzard..... 354,058
Washer. See Photographic print washer.
Washing machine, R. & H. Joel..... 354,062
Waste pipe trap, G. Veale, Jr..... 354,075
Watch case, D. O'Hara..... 353,706, 353,961
Watch case center, W. H. Fitz Gerald..... 353,935
Watch case centers, manufacture of, W. H. Fitz Gerald..... 353,930
Watch cases, manufacture of, W. H. Fitz Gerald.. 353,932
Watch cases, manufacture of crowns for, W. H. Fitz Gerald..... 353,929, 353,931
Watch, stem winding, A. L. Keller..... 353,657
Watch, stem winding, C. V. Woerd..... 354,002
Watch, stop, H. A. Lugrin..... 353,795
Watches, pendant stem for, A. L. Keller..... 353,749
Water closet cisterns, etc., pull for, W. Burrows.. 353,844
Water gauge, T. H. Cheek..... 353,920
Water meter, oscillating, L. H. Nash..... 353,699, 353,806
Water meter, proportional, L. H. Nash...353,700 to 353,702
Water meter with revolving non-rotating piston, L. H. Nash..... 353,703
Water meter with revolving pistons, J. A. Tilden. 353,883
Weight motor, H. A. Spencer..... 353,717
Wheel. See Car wheel. Carriage wheel. Vehicle wheel. Wagon wheel.
Wheel, J. S. Black..... 353,010
Whiffletree bolt blanks, machine for making, J. Stacker..... 353,830
Winding yarn, machine for, W. T. Hanson..... 353,745
Windmill, G. & E. Wallenbeck..... 353,721
Windows and shutters, fastener for, R. P. Hall... 353,936
Wire drawing apparatus, S. H. Byrne..... 353,663
Wire drawing drum, W. W. Shearer..... 353,975
Woven fabric, D. B. Kerr..... 353,790
Wrench for twisting wires, A. L. Zuck..... 354,079

DESIGNS.

Badge, Lukanitsch & Cosman..... 17,022
Branding iron, J. G. Kostmayer..... 17,021
Brush, crumb, W. K. Northall..... 17,015
Cable cord, ornamental, T. R. Lees *et al*..... 17,014
Carriage body, H. C. Sears..... 17,018
Grate, fire, J. Burkhardt..... 17,019
Medal, C. C. Penfold..... 17,017
Tile, J. H. Hankinson..... 17,020
Type, font of printing, W. F. Captain..... 17,013
Wall paper, W. N. Peak..... 17,016
Watch case, Bapst & Falize..... 17,012

TRADE MARKS.

Belting of canvas, duck, and woven cotton, Chesapeake Belting Co..... 13,848
Corsets, Warner Bros..... 13,862
Cotton and silk on spools, yarns, and twists, I. Einhorn..... 13,855
Cotton and silk on spools, yarns, buttons, tapes, braids, and twists, I. Einhorn..... 13,856
Cotton fabrics, J. R. MacColl..... 13,858
Meats and lard, cured and canned, Armour Packing Co..... 13,853
Medicines, astringent, Synvita Company..... 13,850
Remedies in solid form for bronchical and other diseases, Synvita Company..... 13,851
Remedy for apoplexy and kindred diseases, F. S. Hutchinson & Co..... 13,857
Remedy for constipation, A. M. Walrath..... 13,852
Soap, toilet, Graham Bros. & Co..... 13,849
Tooth paste and tooth wash, Curran & Goler..... 13,854
Whisky, Stein Bros. & Baumgartl..... 13,861
Whisky, rye and other, Sour Mash Distilling Company..... 13,859, 13,860
Wire, barbed, California Wire Works..... 13,847

A printed copy of the specification and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, at a cost of $40 each. For full instruction address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

SEBASTIAN, MAY & CO'S
Improved Screw Cutting
LATHES Foot & Power

$60.
Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. *Lathes on trial.*
Catalogues mailed on application
165 W. 2d St., Cincinnati, O.

THE USE OF TORPEDOES IN WAR.—A paper by Commander E. P. Gallert, U.S.N., giving a clear presentation of the present state of efficiency of the torpedo, the degree of perfection that it has now reached, and describing the kinds which are in ordinary use in all naval services. With 3 plates, containing many figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **536** and **537**. Ten cents each. To be had at this office and from all newsdealers.

BIT. Square, Oval, or Round Smooth Holes. For carpenter, cabinet, and pattern work. ½in. 50c., set $4.00, mailed free. Bridgeport Gun Implement Co., 17 Maiden Lane, N. Y.

EDISON

Lamps for Christmas tree and other decorations. THE LARGEST STOCK OF LAMPS IN THE UNITED STATES, ranging from ¼ to 100 candle power, for both battery and dynamo.

CHRISTMAS PRESENTS

for your scientific children or friends.

Magic Lantern, Electric Lamp and Battery,	$40.00
"B" Battery and 3 Candle Lamp,	5.00
"B" Battery and 6 Candle Lamp,	7.00
Electric Railway, complete,	8.50
Surgical Illuminator, complete,	12.00
Ano Kato, the children's electrical toy—no battery—lots of fun, and cannot get out of order.	.75
By mail,	.90
Electric Motors, Primary and Storage Batteries, etc.	
Statue of Liberty, mounted with 3 Candle Lamp, with battery complete,	12.00
Do. with 6 Candle Lamp and Battery,	15.00

For catalogue, send 5-cent stamp for postage.

The Stout-Meadowcroft Co.,
82 & 84 Fulton Street,
NEW YORK.
Authorized Agents of the Edison Lamp Co.

SCIOPTICONS, MAGIC LANTERN SLIDES
MARCY'S ELECTRIC FOCUS LAMP.
LIME LIGHT MADE EASY. SEND FOR CIRCULARS.
L. J. MARCY, 1604 Chestnut St., Philada.

THE BACTERIA OF DISEASE.—BY DR. Henry Hun.—The contents of the air we breathe. The nature of bacteria. Classification of bacteria. Useful bacteria. The bacteria of disease. With 16 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **545**. Price 10 cents. To be had at this office and from all newsdealers.

2d HAND MACHINERY Lists sent. N.Y. Machinery Depot, Bridge Store No. 16, Frankfort Street, N. Y.

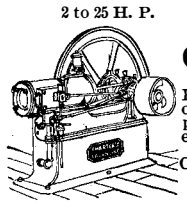
Syracuse Malleable Iron Works

MINERAL WOOL.

A fire-proof insulator of heat and sound. Samples and price list free. U. S. MINERAL WOOL CO.,
22 CORTLANDT STREET, N. Y.

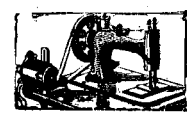
EXCELLENT BLACK COPIES of *anything written* or *drawn* with *any* Pen (or Type Writer) by the Patent **AUTOCOPYIST** Only equalled by Lithography. Specimens Free.
AUTOCOPYIST CO., 3 Thomas Street, New York.

The STATUE of LIBERTY, NEW YORK. The great work of Bartholdi, the largest statue ever erected by man, just inaugurated on Bedloe's Island, New York Harbor, fully described. The history of its inception, how the work was carried out, chronology of the operations and full engineering and popular details as to construction, mode of erection, size, thickness of metal, etc. Fully illustrated by drawings, showing the work as completed, the elevation of the pedestal and framework, and the statue as it appeared in process of construction. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 564. Price 10 cents. To be had on application, or by mail, at this office and from all newsdealers.

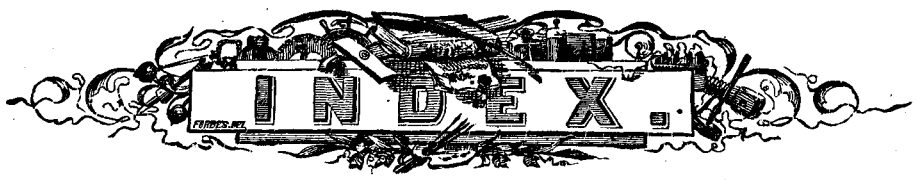
2 to 25 H. P.

CHARTER'S
GAS ENGINE.
Warranted equal to any in Power and Economy, and Superior to all in Simplicity and Compactness. Gives an Impulse at every Revolution.
H. H. LATHAM,
Chicago Agent, 115 Monroe Street.
Williams & Orton Mfg. Co.,
P. O. Box 148. STERLING, ILL.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.


THE ONLY PRACTICAL ELECTRIC MOTORS FOR FAMILY SEWING MACHINES.
THE ELECTRO-DYNAMIC CO. PHILA.
224 CARTER ST. PHILADA. PA.

© 1886 SCIENTIFIC AMERICAN, INC



ILLUSTRATIONS.

A

Adding machine..... 18
Air in pores of wood..... 228
Air pump experiments..... 199
Air pump, inexpensive..... 185
Apertures in vessels..... 323
Apes at home..... 263
Aquatic arena, Paris..... 280
Aqueduct, New York..... 319
Ash sifter..... 131
Artillery firing..... 361

B

Ball, projected..... 57
Balls, collision..... 38
Balloon trip, a..... 249
Banjo frame, Dobson's..... 51
Barometer, glycerine..... 403
Barrel cover, new..... 274
Baseball..... 168
Baseball, pitching in..... 71, 229
Baths, Swimming, Paris..... 280
Batting, scientific..... 168
Bear, grizzly..... 393
Bearing, anti-friction..... 51
Beetle, stag, tropical..... 217
Bird, shadow, and nest..... 167
Birds, a ball of..... 233
Blindness from decayed teeth... 110
Blower, blacksmith's..... 166
Boat, torpedo, new..... 88
Boiler cleaner, Millar's..... 227
Boiler drilling machine..... 137
Boiler explosion..... 279
Boiler, safety..... 322
Boiler, steam heating..... 291
Boiler sweeper, Levi's..... 18
Boring and facing machine..... 8
Bouquet holder..... 196
Bracket, lamp, Barney's..... 82
Brake, car..... 323
Bridge, arch, steel..... 255
Bridge, double parabolic..... 278
Brush, rotary..... 115
Bubbles, mercury..... 404
Buckle, Scovil's..... 196

C

Cable grip, Miller's..... 376
Calla lily, triple..... 9
Camera, pinhole..... 52
Capillarity..... 297
Car coupling, Bire's..... 323
Car coupling, Brennan's..... 34
Car coupling, Carruther's..... 34
Car coupling, Hower's..... 258
Car coupling, Locke's..... 402
Car coupling, Requa's..... 329
Car coupling, Springer's..... 258
Car brake, Morrow's..... 323
Car doors, seal for..... 258
Car lock, new..... 104
Car, railway, Estrade's..... 135
Car seat..... 4
Car starter, Gercke's..... 211
Car, tramway, electric..... 215
Cars, construction..... 274
Cart, dumping..... 164
Carillon, improved..... 227
Carriage, child's..... 40
Carriage screen..... 130
Centerboard for vessels..... *275, 324
Chevreul, E..... 179
Chicago..... 120
Chimney cowl..... 131
Chimpanzee Crowley..... 263
Chladni plates..... 151
Churn, Basswell's..... 194
Churn, Madsen's..... 82
Churn, Wagner's..... 227
Clamp, fence, Kirby's..... 371
Clip coupling, Tylee's..... 67
Clock, electric..... 307
Clock movement frame..... 372
Clock, novel..... 390
Clock, polar, Wheatstone's..... 262
Coal receptacle..... 131
Cook, cylinder..... 306
Cock, intermittent..... 164
Coffer dams..... 344
Collar, horse..... 178
Collision balls..... 38
Condenser, surface..... 148
Corn planter, Fragure's..... 66
Cotton chopper, Puls'..... 404
Cotton planter..... 274
Cotton press..... 213
Coupling, car..... 323, 402
Coupling, car, Brennan's..... 34
Coupling, car, Carruther's..... 34
Coupling, car, Hower's..... 258
Coupling, car, Requa's..... 339
Coupling, car, Springer's..... 258
Coupling, car, Walton's..... 210
Coupling, clip, Tylee's..... 67
Cover for barrels..... 274
Cover for fruit jars..... 148
Cracker box covers..... 99
Crane, steam..... 290
Cruiser, French, Tonnant..... 291
Crystal, rock..... 103
Cultivator, Brigg's..... 98
Cup of Tantalus..... 297
Currents of New York Harbor..... 23
Curtain fastener..... 164
Cutting app. for mowers..... 211, 306
Cycloid..... 328
Cyclorama..... 287

D

Dam, coffer..... 344
Danger signal, Phillip's..... 372
Depot, Erie R.R..... 246
Derrick, improved..... 115
Desk attachment, new..... 50
Diamond industry, African..... 339
Diplograph, the..... 99
Disinfecting apparatus..... 134
Door securer, Simon's..... 34
Doubler, Norremberg..... 1, 38
Drain tile protector..... 40
Draught equalizer..... 338
Drawbridge gate..... 290
Drawer check..... 66, 118
Drawing apparatus, Feron's..... 162
Dredger, double..... 294
Drier, Hercules..... 149
Drill for water mains..... 164
Drill for wells..... 116
Driving apparatus..... 73
Dynamo, colossal..... 127

E

Ear for pails..... 258
Earthquake, effects of..... 327
Eel, electric..... 391
Egg beater, Vicker's..... 274
Electric clock..... 307
Electric conduit..... 223
Electric eel..... 391
Electric organ..... 83
Electric tramway, Hamburg..... 215
Electric transmission of power.. 232
Electricity, experiment in..... 201
Elevator, fire engine..... 170
Emery grinder, Barne's..... 226
Emery wheel dust..... 83
Engine, Hord's..... 356
Engine, rotary, Belt's..... 98
Engine, six cylinder..... 86
Engine, steam, Lonque's..... 338
Engine, steam, Mennig's..... 25
Engine, steam, Rush's..... 178
Engine, winding, colliery..... 39
Engines of St. Ozone..... 243
Equalizer, draught..... 338
Equilibrium of fluids..... 311
Eureka, yacht, propulsion..... 47
Evaporating pan..... 403
Exhibition at Venice..... 309
Exposition, Minneapolis..... 20

F

Facing machine..... 374
Fastener for stoppers..... 180
Feed water regulator..... 371
Fence clamp, Kirby's..... 371
Fence, picket..... 130
Fence, railroad..... 306
Fence wire tightener..... 67
File stand, Parson's..... 162
Films, thin, study of..... 38
Filter, rain water..... 104
Fire engine elevator..... 170
Fire escape, Fogarty's..... 130
Firearm lock..... 372
Fireworks..... 69
Fishes, Malayan..... 339
Floods in India..... 259
Flour chest..... 307
Fluids, experiments with..... 89
Fluids, equilibrium of..... 311
Fly catcher..... 324
Foam, mercury..... 404
Forges, portable..... 132
Force, centrifugal..... 89
Forces, physical, trans'tion of... 31
Fork, filling, for looms..... 194
Fountain, Herod's..... 360
Fountain, mercury..... 265
Frog, fishing..... 407
Fruit jar cover, new..... 148
Fruit picker, new..... 194
Fruit pulper, Brodling's..... 18
Furnace for boilers..... 290
Furnace grate..... 386

G

Galvanometer, Deprez's..... 358
Game carrier, Stevens'..... 243
Garden tool, Rankin's..... 194
Garment hanger..... 196
Garment, protective..... 118
Gas holders, Birmingham..... 146
Gas meter, great..... 351
Gas stove, Bisbee's..... 166
Gas, weighing..... 370
Gate, drawbridge..... 290
Gate hinge, Cole's..... 194
Gauge, pressure, for leakages.... 163
Gauge, printing press..... 328
Gauge, water..... 371
Generator, steam..... 323
Glass perforated..... 292
Glass, straining by pressure..... 1
Glycerine barometer..... 403
Governor, Clayton's..... 85
Grain conveyor..... 355
Grain weighing machine..... 19
Grate, furnace..... 386
Grip, cable, Miller's..... 376
Guard for cars..... 148
Gun, blow, Guiana..... 121
Gun, English, new..... 279
Gun, Gatling..... 406
Gun, Jansen's..... 104
Gun, walking stick..... 153
Guns, fine..... 51
Guns, mammoth..... 197
Gymnotus..... 391
Gyroscopes..... 335

H

Hanger, eaves trough..... 210
Harbor, New York..... 22
Harrow, improved..... 402
Harrow, Owen's..... 402
Head rest, chair..... 131
Heater, steam..... 99
Hinge, gate, Cole's..... 194
Hinge, Wheeler's..... 34
Hippopotamus..... 313
Hook and buckle, new..... 404
Hook, snaps, Stahl's..... 82
Hoop and disk experiment..... 89
Hoist, pendulum..... 211
Hornbills..... 73
Horse collar..... 178
Horseshoe, Monroe's..... 82
Hotel register..... 386
Houses, airing and lighting..... 292
Hub, wheel..... 338
Hydrostatics..... 297

I

Impact, harmonic..... 38
Indicator, water level..... 35
Insulator for wires..... 178, 275
Iron, disintegration..... 105
Ironclad Benbow..... 271

J

Jack, lifting, new..... 168

K

Key, watch, pendant..... 386
Kite, gigantic..... 310
Knife, scraping, for painters..... 4

L

Lamp attachment..... 67
Lamp bracket, Barney's..... 82
Lathe to turn spirals..... 376
Leakages, gauge for..... 163
Lee board, Clapham's..... 114
Liberty, statue of..... 100
Light, polarized..... 262
Light, polarized, experiments.. 1, 19, 38, 55, 70
Light, yellow, for dark room..... 275
Lily, calla, triple..... 9
Liquid emptier..... 4
Lock for firearms..... 372
Lock, railway car..... 104
Lock, seal, Allen..... 258
Lock, spring..... 178
Locomotive attachment..... 327
Locomotive, Estrade's..... 31
Log jam, great..... 161
Loom stop, motion..... 244
Lorises..... 295

M

Macadamsfins..... 159
Machine, Jacquard..... 328
Magnetic curves..... 102
Manatee..... 407
Mantel, sumptuous..... 313
Marmosets..... 41
Mat, door, steel wire..... 5
Medicine chest..... 324
Mercury bubbles..... 404
Mercury fountain..... 265
Meter, gas, great..... 351
Mica cones and wheels..... 19
Milk can refrigerator..... 118
Milk cooler, new..... 147
Mill, Baker's..... 297
Mill, Quaker City..... 166
Mink, the..... 200
Minneapolis Exposition..... 20
Mirror, shaving, new..... 34
Model shaper, ship..... 195
Monitor Peacemaker..... 354
Moscow, burning of..... 69
Mowers, cutting apparatus for.. 211
Mowers, cutter for..... 306
Mummy of Rameses..... 169
Mushrooms on shelves..... 275
Music holder, Smith's..... 4

N

Natural history notes..... 313
Naval maneuvers, French..... 150
New Orleans..... 212
New York harbor..... 22
Night sky..... 3, 81, 161, 209

O

Oil can attachment..... 67
Oiler, Moat's..... 147
Ordnance, heavy..... 191
Ore concentrator..... 242
Ore separator..... 306
Organ, electric..... 83

P

Padlock, Richard's..... 210
Pail ear, Wing's..... 258
Paint, heat-indicating..... 210
Painting machine, wire..... 50
Paradox, wedge..... 57
Park, Morningside..... 79
Pendulum hoist..... 211
Petroleum of Baku..... 54
Petroleum wells..... 279
Pile driver, new..... 147
Pipe, discharge, for vaults..... 66
Pipe wrench, Fatkin..... 84
Pitching, baseball, art..... 229
Pitching, curve, art of..... 133
Pitching in baseball..... 71
Plant protector, new..... 114
Pneumatic gyroscope..... 335
Pneumatics, experiments in, 214, 228, 247
Polariscope..... 70, 262
Polariscope for crystals..... 55
Polariscope, objects for..... 19
Post driver, Reisor's..... 168
Press, cotton..... 213
Pressure, atmospheric..... 9
Propeller, Sylven's..... 307
Pulper, fruit..... 18
Pump, air, experiments..... 199
Pump, force, new..... 194
Pump, measuring..... 307
Pump, Wirtz's..... 360
Pumping apparatus, new..... 18

Q

Quadrumana, the..... 263
Quarry accident, remarkable..... 279
Quilting frame, Wright's..... 67

R

Rafters, measure for..... 242
Railroad fence..... 306
Railroad structures, elevated..... 345
Railway car doors..... 148
Railway car, Estrade's..... 135
Railway car lock..... 104
Railway collision, fearful..... 231
Railway cross ties..... 40
Railway, Meig's..... 21
Railway signal, Martin's..... 18
Railway signal, Tripp's..... 226
Railway track..... 50
Railway track, Noonan's..... 242
Reapers, cutter for..... 306
Refrigerator for fruits..... 115
Refrigerator, milk can..... 118
Register, hotel..... 386
Register, time..... 388
Regulator, feed water..... 371
Riveting tool..... 242
Rock borers..... 312
Rock crystal..... 103
Rubbing machine..... 98

S

Sadiron, new..... 4
Safety engine, Dann's..... 183
Safety fastening for pins..... 355
Sandpapering machine..... 355
Sash balance, Lennon's..... 114
Sash fastener, Cary's..... 82
Sashfastener, Davis'..... 162
Sash opener, new..... 114
Saw, drag, Griswold's..... 210
Saw swage, Ward's..... 372
Seat, car, new..... 4
Seat, vehicle..... 338
Separator for ores..... 306
School, manual labor..... 367
Scraping tool..... 290
Screen, carriage..... 130
Screw driver, Allard..... 211
Sheep shearing table..... 371
Ship Benbow..... 271
Ship model shaper..... 195
Shot case, revolving..... 371
Shovel, improved..... 180
Sifter..... 307
Signal, danger, Phillip's..... 372
Signal, railway, Martin's..... 18
Signal, railway, Tripp's..... 226
Siphon, capillary..... 345, 356
Siphons..... 388
Skeg attachment for vessel..... 355
Sky, night..... 3, 81, 161, 209
Sleigh, Beswick's..... 307
Soldering case..... 258
Sound, experiments in.. 105, 119, 151
Spool and flask experiment..... 89
Spring for vehicles..... 98, 130
Spring lock..... 178
Spring, suspender..... 258
Spring, watchcase..... 66
Stag beetle, tropical..... 217
Statue of Liberty..... 100
Statues of Bamian..... 377
Steam, condensation of..... 9
Steam engine, Betts'..... 98
Steam engine, Dann's..... 183
Steam engine, Louque's..... 338
Steam engine, Mennig's..... 25
Steam engine, Rush's..... 178
Steam engine, 6-cylinder..... 86
Steam generator..... 323
Steam gyroscope..... 335
Steam heater, new..... 99
Steam tricycle..... 390
Steamer, war, Spanish..... 359
Steamers, German, new..... 198
Steamboat, Mississippi..... 212
Steering gear, temporary..... 152
Stethoscope, vibrating..... 248
Stirrup, safety..... 386
Stop for engines..... 5
Stop motion, loom..... 244
Stopper fastener..... 180
Stove, disinfecting..... 134
Stove, gas, Bisbee's..... 166
Sugar evaporating pan..... 403
Sulky, saddle..... 248
Suspender spring..... 258
Swage, saw, Ward's..... 372
Sweeper, boiler, Levi's..... 18
Switch, frogless..... 306
Switch stand, new..... 98

T

Table, sheep shearing..... 371
Tag, address..... 132
Tanks, repairing..... 344
Target, revolving..... 307
Tarsiers..... 295
Telephone, House's..... 303
Telephone, long-distance..... 133
Telephone transmitter..... 403
Terrawerra Lake..... 57
Thermometer, alarm..... 39
Time register..... 388
Ties, cross, railway..... 40
Tires, wagon, setting..... 149
Toboggan, improved..... 243
Tongs, tourmaline..... 262
Top, centrifugal..... 392
Tool, combination..... 211
Top, chameleon..... 239
Top, home made..... 137
Top, scientific..... 230
Torpedo boat, new..... 88
Torpedo boats, new..... 387
Torpedoes, anchoring..... 150
Torpedoes 80 years ago..... 368
Torricelli's principle..... 265
Track, railway..... 50
Tramway, electric, Hamburg..... 215
Transmitter, telephone..... 403
Tricycle, steam..... 390
Tubes, metal, machine for..... 374
Tunnel, new, Berlin..... 310
Tunneling by freezing..... 259
Type writer, cheap..... 246
Type writer, first..... 383
Type writer, Hall..... 24

U

Umbrella support..... 324

V

Vacua, capillary..... 281
Valve, check..... 178
Vehicle, Dinsmore's..... 387
Vessels, carriage of..... 275
Vessels, centerboard for..... 275
Vessel, novel form of..... 386
Vulcanizer, Cawl's..... 115

W

Wagon tires, setting..... 149
Wardrobe attachment..... 196
Washing machine..... 274
Watchcase spring, Stufft's..... 66
Watches, demagnetizing..... 207
Water tower, fall of..... 399
Water gauge..... 371
Water, heating rapidly..... 279
Water level indicator..... 35
Water supply, New York..... 326
Water tower, Victoria..... 264
Water works, Paris..... 168
Water works, system of..... 276
Wedge paradox..... 57
Wells, deep, how made..... 111
Whale, collision with..... 375
Wharf, cotton..... 213
Wheel boring machine..... 374
Wheel hub..... 338
Wheel, measuring..... 66
Whiffletree, improved..... 50
Winding engine, colliery..... 39
Windmill, Wood's..... 50
Window blind..... 114
Window sash opener..... 114
Wire painting machine..... 50
Wires, insulated..... 275
Wrench, pipe, Fatkin..... 84
Wrench, Wood's..... 104
Writing tablet..... 118
Writing machine, first..... 383
Woodworking machine..... 5

Y

Yacht Eureka, propulsion..... 47
Yacht Galatea..... 175
Yacht Mayflower..... 182
Yucca, remarkable..... 135

Z

Zarabatana, the..... 129

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

A

Abyssinian productions..... 129
Academy of Sciences..... 325
Accidents, prevention..... 224
Acid, uric, in animals..... 37
Adding machine, new..... *18
Adulteration of foods..... 208
Advertising, novel way of..... 18
Advice, good..... 291
Aerostats, steam for..... 401
Air, compressed, for lifeboats.. 3, 53
Air, compressed, for motors..... 117
Air, compressed, use of..... *388
Air pump experiments..... *199
Air pump, inexpensive..... *185
Albany, bicentennial of..... 34
Alcohol, for and against..... 197
Alcohol from turpentine..... 153
Alcohol, poppy..... 149
Ale, clarifying..... 149
Alloy, a useful..... 305
Alloy, expansible..... 88
Alloy, lechesne..... 340
Alum, clarifying by..... 3
Aluminum tin..... 242
Amazon River, descent..... 389
American Association..... 60, 114, 154
American Institute Fair..... 170, 308
Anaconda, large..... 248
Anguillalæ, life of..... 394
Animals and plants..... 394
Animal power vs. steam..... 100
Animals, blue color of..... 234
Animals, care of..... 122
Animals, eyeless..... 234
Animals, fear in..... 274
Anthracite, discoverer of..... 372
Ants, to destroy..... 41
Apertures in ships..... *323
Aquatic arena, Paris..... *280
Aqueduct, New York..... *326
Architecture and mechanics..... 23
Armorclads, French and British. 341
Arms, small, manufacture..... 325
Arthur, Chester A..... 337
Ash sifter..... *131
Asphaltum in building..... 231
Asthma remedy..... 354
Astronomers, problem for..... 133
Atmosphere of caves..... 401
Audubon, reminiscence of..... 341

B

Bacteria in the air..... 217
Bakusine..... 130
Balance, spring..... 66
Ball, projected..... *57
Balls, collision..... *38
Balloon photography..... 166
Balloon trip, a..... *249
Balloon voyage, a..... 132
Balloons, steam for..... 401
Banjo frame, Dobson's..... *51
Barff, Prof..... 273
Barometer, glycerine..... *403
Barometer, whistling..... 114
Barrel cover, new..... *274
Barytes in white lead..... 273
Baseball..... 64, *168
Baseball, pitching in..*71, 106, 129 *229
Baths, swimming, Paris..... *280
Battery, electric, improved..... 33
Bay rum..... 53
Bear, grizzly..... *393
Bearing, anti-friction..... *51
Bee in a telephone..... 118
Bee's sting a useful tool..... 353
Beer, clarifying..... 149
Beetle, carpet, Buffalo..... 35
Beetle, stag, tropical..... *217
Bell five hundred years old..... 160
Belting experiments..... 105
Belts, leather, slipping..... 341
Bert, Paul..... 321
Bird life in Central Park..... 352
Bird, shadow, and nest..... *167
Birds, a ball of..... *233
Birds, destruction of..... 260
Birds, soaring..... 154
Bismuth, fluorescence..... 385
Blind, dreams of..... 312
Blake, Eli W..... 127
Blower, blacksmith's..... *166
Boat, electric..... 193
Boat, electric, Volta..... 260
Boat, torpedo, new..... *88
Boats, torpedo..... *387
Boats, torpedo, in the gale..... 48
Boats, 1¼ pound..... 130
Boiler cleaner, Millar's..... *227
Boilers, cold zone in..... 369
Boiler drilling machine..... *137
Boiler explosion..... *279
Boiler explosion, recent..... 304
Boiler, safety..... *322
Boiler, steam heating..... *291
Boiler sweeper, Levi's..... *18
Boring and facing machine..... *8
Bottles, labeling..... 106
Bouquet holder..... *196
Boy inventors..... 55
Boys, give them a chance..... 234
Boys, our..... 80
Bracket, lamp, Barney's..... *82
Brake, car, Morrow's..... *323
Brake shoes..... 56
Brake tests, freight..... 145
Brakes, railway..... 56
Brass, to clean..... 8
Brass work, lubricant..... 151
Brewery, Guinness', sale..... 372
Brick making..... *343
Bricks, how to stain..... 17
Bridge, arch, steel..... *255
Bridge, double parabolic..... *278
Bridge, new, London..... 50
Bridge, Niagara..... 106
Bromidia..... 185
Brush, rotary..... *115
Bubbles, mercury..... *404
Buckle, Scovil's..... *196
Bullet post..... 177
Business amiability..... 388

C

Cabbage flies..... 245
Cable grip, Miller's..... *376
Cable roads, Chicago..... 359
Calculi, new solvent of..... 153
Calla lily, triple..... *9
Calorimetry with oxygen..... 81
Cameo cutting..... 392
Camera, paper..... 144
Camera, pinhole..... *52
Canal, Panama..... 67
Canal, ship, Manchester..... 99
Canals, important..... 177
Canals, new Russian..... 97
Canine reason..... 233
Cannon ball, torpedo..... 389
Capillarity..... *297
Car brake, Morrow's..... *323
Car coupler tests..... 36
Car coupling..... *402
Car couping, Boie's..... *323
Car coupling, Brennan's..... *34
Car coupling, Carruther's..... *34
Car coupling, Hoover's..... *258
Car coupling, Requa's..... *339
Car coupling, Springer's..... *258
Car coupling, Walton's..... *210
Car doors, seal for..... *258
Car lock, new..... *104
Car, railway, Estrade's..... *135
Car seat, new..... *4
Car starter, Gercke's..... *211
Cars, construction..... *274
Carbon, electric resistance..... 339
Caries, dental, in bakers..... 307
Carillon, improved..... *227
Carnegie, Andrew..... 58
Carriage, child's..... *40
Carriage screen..... *130
Carriages, care of..... 241
Cart, dumping..... *164
Casting, centrifugal..... 37
Castings, Indian, peculiarity of.. 7
Casts, plaster, how made..... 338
Cataract, treament of..... 73
Cattle disease, remarkable..... 384
Caves, atmosphere of..... 401
Cedar oil..... 201
Cellar, how to cool..... 33
Cement and lime..... 261
Cement in Ireland..... 231
Cement, magnesia in..... 37
Cement, new, from slag..... 371
Cement, Paris..... 357
Cement, slag..... 308
Centerboard for vessels..... *275, *324
Centrifugal top..... *392
Channelways of New York..... 112
Checking apparatus..... 194
Chemistry without apparatus..... 16
Chevreul centenary..... 165
Chevreul, E..... *179
Chicago..... *120
Chimney cowl..... *131
Cholera hospital, model..... 276
Chronometer, D'Arsonval's..... 132
Chrysamin..... 202
Churn, Lasswell's..... *194
Churn, Madsen's..... *82
Churn, Wagner's..... *227
Cider, clarifying..... 149
Cider making process..... 148
Circulation, mileage of..... 265
Clamp, fence, Kirby's..... *371
Clarifying cider..... 149
Clip coupling, Tylee's..... *67
Cliff of glass..... 278
Clock, electric..... 307
Clock, magnetic..... 162
Clock movement frame..... *372
Clock, novel..... *390
Clock, polar, Wheatstone's..... *262
Cloth, how to tin..... 146
Cloth, waterproofing..... 247
Clubs, Indian, home made.. 106, 277
Coal, a ton of..... 374
Coal, anthracite, discoverer of... 372
Coal, bituminous, products..... 72
Coal dust, ignition of..... 169
Coal formation, theory..... 245
Coal, products of..... 196
Coal receptacle..... *131
Coast defense ordnance..... 96
Cock, cylinder..... *306
Cod liver oil..... 8
Coffin, explosion of..... 149
Cold and tobacco smoking..... 312
Cold mixture..... 104
Cold zone in boilers..... 269
Collar, horse..... *178
Colliery, Woodward..... 359
Collision balls..... *38
Color, analysis of..... 227
Colors, influence of light on..... 147
Colors, water, effect of light..... 265
Combustion, heat of..... 209
Combustion, slow..... 213
Comet, Winnecke's..... 226
Compass affected by a truss..... 277
Compressed air power scheme..... 376
Condenser, surface..... *148
Congress, adjournment..... 97
Connecticut, health in..... 17
Converters, Bessemer..... 312
Copper bromide, intensifier..... 387
Cork..... 65
Corks, impervious..... 35
Corn planter, Fragure's..... *66
Corn silk..... 197
Cornell University, progress..... 384
Corundum, uses of..... 84
Cotton chopper, Puls'..... *404
Cotton, dyes for..... 132
Cotton planter..... *274
Coupler fiend, the..... 5
Coupling, car..... *402
Coupling, car, Bole's..... *323
Coupling, car, Brennan's..... *34
Coupling, car, Carruther's..... *34
Coupling, car, Hoover's..... *258
Coupling, car, Requa's..... *339
Coupling, car, Springer's..... *258
Coupling, clip, Tylee's..... *67
Couplings, car, tests of..... 36
Couplings, open and close..... 154
Cover for barrels..... *274
Cover for fruit jars..... *148
Cow, scarlet fever in..... 53
Cracker box cover..... *99
Cracks in floors, filling..... 149
Crane, steam..... *290
Crater, afloat in..... 330
Crater Lake, Oregon..... 192
Cremation at Pere la Chaise..... 136
Cruiser, dynamite..... 336
Cruiser, French, Tonnant..... *291
Cruisers, the new..... 80
Crystal, rock..... *103
Cultivator, Briggs'..... *98
Cup of Tantalus..... *297
Currents of New York harbor..... *23
Curtain fastener..... *164
Cutting app. for mowers..... *211, *306
Cuttlefish..... 51
Cycling, hygiene of..... 341
Cycloid..... *328
Cyclorama..... *296
Cyclone, an ancient..... 200

D

Damaskeening..... 261
Damming water..... 406
Danger signal, Phillip's..... *372
Dangers, unnoticed..... 184
Deer hunting with steam..... 354
Depot, Erie R.R..... *246
Derrick, improved..... *115
Desk, attachment, new..... *50
Developers, photo..... 2
Developer, sulph. acid..... 85
Diamond industry, African..... *339
Diamonds..... 360
Diarrhœa, remedy..... 106
Dietetic fallacies..... 309
Diffusion process..... 148
Diphtheria and manure heaps... 355
Diplograph, the..... *99
Disasters at sea..... 258
Disease, cattle, remarkable..... 384
Disease germs in milk..... 96
Disease, sleeping..... 40
Disinfectant, new..... 147
Disinfecting apparatus..... *134
Diversity of opinion..... 34
Doctors, German..... 273
Door securer, Simon's..... *34
Doubler, Norremberg..... *1
Doubling small amounts..... 25
Drain tile protector..... *40
Drainage, main..... 276
Drainage scheme, Florida..... 117
Draught equalizer..... *338
Drawbridge gate..... *290
Drawer check..... *66, *118
Drawing apparatus..... *162
Drawings, reproduction of..... 145
Dredger, double..... *294
Drier, Hercules..... *149
Drinkers' diseases..... 65
Driving apparatus..... *73
Drinking, science of..... 288
Drowned, resuscitation..... 215
Drags, East African..... 344
Dust, dangers of..... 99
Dyes, yellow, for cotton..... 132
Dynamite cruiser..... 336
Dynamite gun, pneumatic..... 16
Dynamo, colossal..... *127
Dynamo Colossus at work..... 305
Dynamo, 161, efficiency of..... 7
Dyspepsia, prescription..... 216

E

Ear for pails..... *258
Earache liniment..... 97
Earthquake, Charleston, 181, 229, 308
Earthquake, effects of..... *327
Earthquake, great..... 176
Earthquake of August 31..... 161
Earthquake, recent..... 277
Earthquake, Savannah..... 309
Earthquake waves..... 52
Earthquakes..... 277
Eel, electric..... *391
Eclipse of sun, recent..... 225
Egg beater, Vicker's..... *274
Eggs, diseased..... 135
Eggs, to tell age of..... 329
Egypt, ancient condition of..... 5
Electric battery, improved..... 33
Electric boat..... 193
Electric boat, Volta..... 260
Electric clock..... *307
Electric conduit..... *223
Electric eel..... *391
Electric foot warmer..... 195
Electric lamps for miners..... 250
Electric light and fire losses..... 385
Electric light, value of..... 49
Electric light wire legislation... 257
Electric motor, Daft's..... 192
Electric motor, new..... 291
Electric organ..... *83

© 1886 SCIENTIFIC AMERICAN, INC

Electric railway 339
Electric silo cutter 81
Electric sword 274
Electric thermometer *89
Electric tramway, Hamburg *215
Electric transm. of power *232
Electric wires, Brooklyn *384
Electric wire insulator *178
Electrical patent decision 356
Electrical subways 64
Electrical subways, New York 36
Electricity, experiment in ..... * 202
Electricity of the lightning flash 8
Electricity, positive and negative 68
Electricity, welding by 208
Electro-osteotome 294
Electrotyping solution, new 4
Elevator, fire engine *170
Elevator, take the 273
Emery grinder, Barne's *226
Emery wheel dust *83
Emulsion plates, rapidity 229
Emulsions 129
Emulsions, gelatine 170
Endorsing, evils of 289
Engine, gas 385
Engine, Herd's *356
Engine, petroleum 328
Engine, rotary, Belt's *98
Engine, six-cylinder *86
Engine, steam, Louque's *338
Engine, steam, Mennig's *25
Engine, steam, Rush's *178
Engine, winding, colliery *39
Engines of ship Ozone *243
Engines, triple expansion 311
Engineer, woman 389
Engineers, locomotive 297
Engineers, mechanical, conven 369
Enlarging for newspapers 257
Equality 407
Equalizer, draught *338
Equilibrium of fluids *311
Erysipelas, treatment 82
Etna, eruption of 67
Eugenol 196
Eureka, yacht, propulsion *47
Evaporating pan *404
Exhibit, woodmaking 152
Exhibition, Edinburgh 57
Exhibition in Spain 209
Exhibition, Minneapolis 145
Exhibition of three Americas 23
Exhibition telephone 374
Explosive, new 386
Exposition, Cincinnati 132
Exposition, Minneapolis *20
Eyes, effect of paper on 320

F

Fabric, woolen, cleaning 69
Fabrics, woolen, to clean 209
Facing machine *374
Farmer, Western, views of East 373
Fastener for stoppers *180
Fear in animals 274
Feed water pipes 313
Feed water-regulator *371
Fence clamp, Kirby's *371
Fence, picket *130
Fence, railroad *306
Fence wire tightener *67
Ferrates, the 131
Fever, scarlet, in cow 53
Fever, scarlet, prevention 388
File stand, Parson's *162
Films, how to strip 257
Films, removal of 106
Films, thin, study of *38
Filter, rain water *104
Filtration of water 354, 386
Financiering, ingenious 359
Firearms, lock for 405
Fire at chemical works 7
Fire damp indicator 56
Fire engine elevator *170
Fire escape, Fogarty's *130
Fire extinguishing apparatus 85
Fire from steam pipes 82
Fires, theater 52
Firearm lock *372
Fireproofing wood 311
Fireworks *69
Fish drying machine wanted 7
Fishes, brainless 394
Fishes, Malayan *329
Fishes, swim-bladder of 394
Flax, retting process for 258
Flies, propagation of 296
Floods in India *259
Flour chest *307
Flour, decline in 131
Flower post, novel *340
Flowers 345
Flowers, preservation 214
Fluid, preservative 354
Fluids, equilibrium of *311
Fluorescence of bismuth 385
Fly catcher *324
Food, preservation of 201
Foods liable to adulteration 208
Foolhardiness 248
Foot warmers, electric 195
Force, centrifugal *89
Forces, physical, transforma. of *31
Forehead, noble, fallacy 247
Forges, portable *132
Forging, steel, great 83
Forgings, gun, called for 193
Fork, filling, for looms *194
Foundations 89
Fountain, Hero's *360
Fountain, petroleum, great 340
Fruit jar cover, new *148
Fuel, petroleum as *390
Frog, fishing *407
Fruit picker, new *194
Fruit pulper, Bradley's *18
Fuel, oil, not economical 67
Fungus, a new 234
Furnace, electric, Cowle's 154
Furnace for boilers *290
Furnace grate *386
Furnaces, blast, U. S 392

G

Galatea and Mayflower *181
Galvanometer, Deprez's *358
Game carrier, Steven's *243
Gapes in fowls 306
Garden tool, Rankin's *194
Garment hanger *196
Garment, protective *118
Gas 344
Gas belt, natural 113
Gas, distribution of 357
Gas engines 385
Gas holder, gigantic 345
Gas holders, Birmingham *146
Gas industry, and patents 128
Gas industry, the 2
Gas lighting by incandescence 337
Gas locomotive, successful 193
Gas meter, great *351
Gas meter wanted 147
Gas, natural, and coal 236
Gas, natural, cost 260
Gas, natural, Michigan 178
Gas, natural, New York 113
Gas, natural, Ohio 33, 51
Gas, sewer, dangers 339
Gas stove, Bisbee's *166
Gas, water, new method 256
Gas, weighing a *370
Gaslight Association 272
Gases, diffusion of 72
Gate, drawbridge *290
Gate hinge, Cole's *194
Gauge, printing press *328
Gauge, water *371
Generator, steam *323
Geology, cosmopolitan 54
Girders, cast iron 169
Girders, weights and strengths 17
Glass, how colored 147
Glass, perforated *292
Gloss for shirt bosoms 194
Gloss for linen 323
Glycerine barometer *403
Gold is king 201
Governor, Clayton's *35
Grafting, heterogeneous ..... * 41
Grain conveyor *355
Grain weighing machine *19
Grate, furnace *386
Grasses, first appearance 234
Grease spots, mixture for 306
Grindstones, breaking of 198
Grindstones, scoring of 144
Grip, cable, Miller's *376
Groceries, New York 359
Guard for cars *148
Gum, kauri 129
Gun barrels, erosion 324
Gun, blow, Guiana *121
Gun, dynamite, pneumatic 16
Gun forgings called for 193
Gun, Gatling *406
Gun, Jansen's *104
Gun, monster 326
Gun, walking stick *153
Gun works, Maxim 225
Gun, 13 ton, new 308
Guns, fine *51
Guns, mammoth *197
Gunpowder, unburned, explos *361
Gymnotus *391
Gyroscope, the *335

H

Habits and work 336
Hanger, eaves trough *218
Harbor improvements 49
Harbor, New York *22
Harrow, improved *402
Harrow, Owen's *402
Headache preventive 392
Headlights 153
Head rest, chair *131
Health in Connecticut 17
Health, ministry of 200
Health treatment 387
Heart disease and smoking 337
Heart, mechanism of 390
Heat, economy of 288
Heat of combustion 209
Heater, steam, new *99
Heating water 112
Heating water rapidly 369
Henrietta, steam launch 16
Hiccough, cure for 165
Highway, public, use of 248
Hinge, gate, Cole's *194
Hinge, Wheeler's *34
Hoadley, John C 405
Hoist, pendulum *211
Hold of an ocean steamer 272
Holes, large, to stop 152
Home, owning a 244
Hook and buckle *404
Hook, snap, Stahl's *82
Hornbills *73
Horse collar *178
Horse, shying 84
Horseshoe, Monroe's *82
Hospital, cholera, model 276
Hotel register *336
Hotel sewage 262
House bill 4,458 6
Houses, airing and lighting *292
Houses, stone, construction 257
Hub, wheel *338
Humming bird, the 209
Hydrogen, peroxide 176
Hydrophobia, cure of 133
Hydrostatics *297

I

Idea, a good 54
Imagination, can it kill? 40
Impact, harmonic *38
Impossible, the 148
Indian clubs, home made 277
Indicator, fire damp 56
Indicator, water level *35
Indigo, African 196
Induction, telephonic 245
Industries, American 100
Insects and epidemics 394
Insect powder 245
Insect's wings, separation 104
Insulator for wires *178, *275
Invention, rewards of 384
Inventions, agricultural 42, 59, 90, 138, 155, 186, 203, 218, 234, 266, 282, 298, 314, 331, 346, 362, 378, 395, 408
Inventions, engineering 10, 26, 42, 59, 74, 90, 107, 138, 155, 171, 186, 203, 218, 235, 266, 282, 298, 314, 331, 346, 362, 378, 395, 408
Inventions, mechanical 235, 266, 298, 314, 362, 378, 408
Inventions, miscellaneous 10, 26, 42, 59, 74, 90, 107, 138, 155, 171, 186, 203, 218, 235, 282, 298, 314, 331, 346, 362, 378, 395, 408
Inventions, unpatented 260
Inventions, some ancient *360
Inventor, rule in favor of 400
Inventor, trials of 327
Inventors, boy 55
Inventors, field for 72
Inventors, reward to 274
Iron and steel production 96
Iron, cast, disintegration *105
Iron clad Benbow *271
Ironclads, fast 229
Iron, cold hammering 102
Iron dissolved by sugar 8
Iron, protection of 115
Iron sand, smelting 306
Iron, gun's action on 181
Ivy poisoning 273

J

Jack, lifting, new *168
Jaw, human, not evolved 273
Joint material, new 88
Jute goods industry 281

K

Keep on the alert 34
Key, watch pendant *386
Kilauea again active 133
Kite, gigantic *310
Knife scraping for painters *4
Krakatoa 87

L

Labels, paste for 361
Lake, Crater, Oregon 192
Lake Tahoe 196
Lakes, drying up of 185
Lamp attachment *67
Lamp bracket, Barney's *82
Lamps, electric for miners 260
Lamps, management of 390
Lamps, petroleum 53
Lathe to turn spirals *376
Launch, steam, fastest 16
Laundry hints 388
Lawsuits, avoid 280
Lead, tea chest 183
Lead, Roman 20
Leaks in water mains 276
Leather belts, slipping 341
Leather tanning 106
Leaves, cotyledinary 394
Leaves, starch grains in 4
Lechesne alloy 340
Lee board, Clapham's *114
Legislation, patent 32
Leidenfrost's drops 160
Liberty, statue of *100, 272, 288, 320
Life boats, compressed air for 8
Life boats, motor for 53
Life failures 227
Life in formation of earth 353
Life, our, length of 97
Lifting jack, new *168
Light, electric, and fire losses 385
Light, electric, value of 49
Light, Hell Gate, stoppage 330
Light, penetration in water 193
Light, polarized *262
Light, polarized, experiments *1, *19, *38, *55, *70
Light, velocity of 170
Lightning flash, electricity of 8
Lightning melts water pipe 371
Lightning stroke, a 58
Lily calla, triple 49
Lime and cement 261
Liniment, earache 97
Liquid emptier *4
Lithographers, hints for 392
Lock, firearm *372
Lock for firearms 405
Lock, railway car *104
Lock, seal, Allen *258
Lock spring *178
Locomotive attachment *327
Locomotive boiler valve *178
Locomotive building 177
Locomotive engineers 297
Locomotive, Estrade's *31
Locomotive, gas, successful 193
Locomotive headlights 153
Locomotive, small 260
Locomotives, soda 154
Log jam, great *101
Looms, stop motion *245
Lord, Jesse H 321
Lorises *295
Lubricant for brasswork 151
Lubricators 153

M

Macadamsfins *159
Machine, Jacquard *328
Machinery, benefits 213
Machinery, what it does 153
Magazine, Scribner's 406
Magnesia in cement 37
Magnesium torch, a 58
Magnetic curves *102
Magnetism, influence of 233
Magnets 361
Mail matter, minute 100
Making and manufacturing 117
Malta, Island of 85
Man, elements of a 202
Manatee *407
Manger, cleansing 275
Mantel, sumptuous *313
Maps, railway, large 341
Marmosets *41
Mars, planet 97
Mat, door, steel wire *5
Measure, a standard 216
Meat, frozen, trade 337
Mechanic arts of Cornell 225
Mechanics and architecture 23
Medicine chest *324
Men, great, occupations 387
Mercury bubbles *404
Mercury fountain *265
Message, President's 384
Metals, coloring of 353
Metals, effects of heat 21
Metals, reducing 41
Metals, varnish for 385
Meter, gas, great *351
Meteorite of May 10 72
Meteor showers 385
Meteor, struck by a 65
Mica cones and wheels *19
Microscope 102
Milk as an absorbent 257
Milk can refrigerator *118
Milk cooler, new *147
Milk, disease germs in 96
Milk, poison in 112
Milk, rubber 234
Mill, Barker's *97
Mill, Quaker City *166
Millinery, simple 329
Mine drainage 276
Mineral products of U. S 289
Mineral specimens, Spanish 337
Mining, deep, Comstock 294
Mining, submarine 248
Mink, the *200
Minneapolis Exposition *20
Mirror, shaving, new *34
Mocking bird food 66
Model-shaper, ship *195
Moles, iron, floating 72
Monitor Peacemaker *354
Monkeys, rare 176
Monument, interesting 312
Morrhuol 8
Mortar, hydraulic 55
Mortar, sweetened 291
Mortar, the Fere 240
Moscow, burning of *69
Moss, destruction of 4
Mosses, club, development 234
Mosses, how to collect 338
Motor, Daft 192
Motor, electric, new 291
Motor for torpedoes 53
Motors, gas 385
Motors, water, efficiency of 17, 49
Mullein, a large 394
Mummy of Rameses *169
Museum, Kensington *343
Mushrooms on shelves *275
Music holder, Smith's *4
Muspratt, James 17
Mowers, cutter for *306
Mowers, cutting app. for *211

N

Natural history notes 234, 250, 394
Naturalists, German 273
Nature, remedies of 224
Nature the great teacher 240
Naval maneuvers, French *150
Navies of Britain and France 341
Navigation, aerial 53, 201
Navigation, inland 177
Navy, the new 305
Navy's needs 352
Negative, a great 225
Negatives, intensifying 106
Negatives, over-intense 85
Negatives, paper 216
Negatives, retouching 241
Neuralgia ointment for 341
New Orleans *212
New York Harbor *22
Newspaper prints, transfer 200
Nichols, Ripley 361
Night sky *3, *81, *161, *209
Nitroglycerine, destruction by 369
North, the new 321
Novelty wanted 68

O

Obelisk, decay of the 181
Obesity, Galen on 69
Observatory, mountain 41
Oil can attachment *67
Oil, cod liver 8
Oil fuel not economical 67
Oil, government payments 376
Oil of cedar 201
Oil on the water 131
Oil, verbena, source 104
Oiler, Moat's *147
Ointment, neuralgia 341
Oleomargarine 118
Opiates, avoid 394
Opium, Minnesota 181
Optical illusion 258
Ore concentrator *242
Ore separator *306
Ordnance, coast defense 66
Oregon, wreck of the 64
Organ, electric *83
Osteome, electro 294
Ostriches at Los Angeles 289
Oxygen, solidified 5

P

Padlock, Richard's *210
Pail ear, Wing's *258
Painting machine, wire *50
Palms, cocoa, and lightning 246
Panama canal 67
Papaine 119
Paper, bromide 73
Paper, sensitizing 118
Paper, transparent 214
Paradox, wedge *57
Park, Central, New York 130
Park, Morningside *85
Paste for labeling 361
Patent, electrical, decision 356
Patent legislation 32
Patent office 384
Patent office receipts 225
Patent rights as property 248
Patent rights libel as to 394
Patents and gas industry 128
Patents, decision relating to .. 7, 56, 85, 122, 152, 216, 264, 289, 309, 257, 385
Patents, points on 247
Patentees, duties of 229
Pavements, slag 394
Pecan tree 202
Pendulum hoist *211
Pendulums, compensating 6
Perkins, Geo. L 73
Petroleum as fuel *390
Petroleum engine 328
Petroleum fountain, great 340
Petroleum in Egypt 7
Petroleum lamps 53
Petroleum of Baku *54
Petroleum pipe line 294
Petroleum wells, Egypt *279
Phenomenon in Venezuela 389
Photographers, convention of 36
Photographic notes 2, 17, *52, 73, 85, 106, 112, 129, 144, 170, 216, 229, 241, 257, 385
Photographs, enameling 229
Photographs, large, mounting 385
Photography, balloon 166
Photography, color tone 17
Photography, composite 169
Photography, phosphorescent 241
Photometry 84, 192
Photo-plates, orthochromatic 257
Photo-printing on silk 245
Photo-prints, stain in 17
Photo-silver waste 289
Photo-zincotypy 49
Photos for engraving 211
Phosphorescent materials 376
Pigeons, homing, collection of 165
Pile driver, new *147
Pile driving by dynamite 50
Pile, discharge for vaults *66
Pipes, feed water 313
Pipe, steel 337
Pipe wrench, Fatkin *84
Piston area and heating surface 257
Piston valves, locomotive 340
Pitching, baseball, art *229
Pitching, curve, art of *133
Pitching in baseball *71
Planter, a large 129
Planet Mars 97
Plant protector, new *114
Plant tendrils 394
Plants, ant-inhabited 391
Plants, comicalities in 41
Planting, spring 328
Plaster casts, how made 338
Plates, photo, varnish for 216
Pneumatic gyroscope *335
Pneumatics, experiments *214, *228, *247
Pneumonia, cause of 2
Pneumonia, treatment 119
Polar inspection, South 25
Polarity of tadpoles 3, 69
Polariscope *70
Polariscope for crystals *55
Polariscope, objects for *19
Pomade for the hair 68
Poppy alcohol 149
Post driver, Reisor's *168
Posy, a sweet 264
Potato, tercentenary of 337
Powder, combustion of 389
Power, compressed air, scheme 376
Power, sources of 330
Power, transmission of 80
Preservative wanted 309
President's message 384
Pressure, atmospheric *9
Printing, making ready for 52
Prints, blue, changing 113, 241
Prints, bromide 241
Prints, curling of 241
Prints, newspaper, transfer of 200
Prints, photo, stains in 17
Problem, great, the nation's 32
Professions in France 72
Promise of better things 20
Propeller, Sylven's *307
Propulsion of steamers 401
Public works, estimates on 9
Publication, prior 372
Pulleys, iron, lagging 8
Pulper, fruit *18
Pump, air, experiments *199
Pump, air, inexpensive *185
Pump, force, new *194
Pump, measuring *307
Pump, Wirtz's *360
Pumping apparatus, new *18
Pustule, malignant 49
Pyrofuxin 375

Q

Quadrumana, the *263
Quadrupeds, skinning 151
Quarrying, Greek 58
Quilting frame, Wright's *67
Quinine, artificial 210

R

Rabies, treatment of 136, 168
Race of steam yachts 65
Radiator, cream and milk 211
Radiophone, the 16
Rafters, measure for *242
Rails, cast glass 259
Railroad fence *306
Railroad signal, new 224
Railroad time, fast 23
Railroads of the world 4
Railroads in Mexico 184
Railway accident, remarkable 304
Railway, Atlantic 184
Railway brakes 56
Railway car doors *148
Railway car, Estrade's *135
Railway car lock *104
Railway collision, fearful *281
Railway cross ties *40
Railway improvement needed 357
Railway electric 339
Railway maps, large 309, 341
Railway motor, Daft 192
Railway mountain 169
Railway signal, Martin's *18
Railway signal, Tripp's *226
Railway speed, remarkable 273
Railway, the Meig's *21
Railway track *50
Railway track, Nooman's *242
Rams, torpedoes vs 336
Reapers, cutter for *211, *306
Refrigerator for fruits *115
Refrigerator, milk can *118
Register, hotel *386
Register, time 388
Regulator, feed water *371
Reservoirs, repairing *344
Residua, recovering 106
Respiration, artificial 180
Retting process, new 258
River, Amazon, descent 389
River improvements 154
Riveting tool *242
Rock borers *312
Rock crystal *103
Rootlets, growth of 394
Rosewood 394
Rubber milk 234
Rubber, old, to dissolve 185
Rubbing machine *98
Rudders, supplementary 355
Rule, a good 400
Rum, Bay, recipe for 53

S

Saccharine 280
Saccharine, inventor of 36
Sad iron, new *4
Safety engine, Dann's *183
Safety fastening for pins *355
Salt mines of Nevada 21
Salt mountain, Palestine 193
Sandpapering machine *355
Sanitary precautions 53
Sash balance, Lennon's *114
Sash fastener, Cary's *82
Sash fastener, Davis' *162
Sash opener, new *114
Saw, drag, Griswold's *210
Sawdust for cleansing 275
Saw swage, Ward's *372
Scarlet fever in the cow 53
School, manual labor *373
Science Assoc., American 80, 114
Scraping tool *290
Screw driver, Allard *211
Screws, rusty, removal 118
Seat, car, new *4
Sea, power of the 193
Seat, vehicle, Steele's *333
Sea, rise at Sabine Pass 277
Sea water as a preservative 40
Seeing and thinking 260
Separator for ores *306
Severn Tunnel, opening 406
Sextant, invention of 328
Sewage, hotel 264
Sewer gas, danger of 339
Sheep shearing table *371
Ship Benbow *271
Ship canal, Manchester 99
Ship Fearless 241
Ship Mayflower 279
Ship model shaper *195
Ship railway 184
Ship transit across the isthmus 64
Ships, forty knot 162
Ships, high speed 65
Ships, ventilation of 167
Ships, war, British 137
Ships, war, protection 212
Shipping convention 392
Shirts, to launder 194
Shoes, straw, Chinese 339
Shot case, revolving *371
Shovel, improved *181
Shutters, drop 129
Sifter *307
Signal, danger, Philip's *372
Signal railroad, new 224
Signal, railway, Martins *18
Signal, railway, Tripp's *226
Silk, adulteration 194
Silk, corn 197
Silk culture, progress of 32
Silo cutter, electric 81
Silotvaar 386
Siphon, capillary *345, *356
Skeg attachment for vessels *355
Skin, beautifying 224
Sky, night *3, *81, *161, *209
Slag, basic, as manure 231
Slag cement 308
Slag, new cement from 371
Slag pavements 384
Slaven, Moses A 257
Sleeping disease 40
Sleigh, Beswick's *307
Smell, delicacy of 37
Smoking and heart disease 337
Snow, removal of 400
Soap to clean clothes 195
Soap, textile 402
Soap, transparent 25
Soaps, process, new 136
Social waste of cities 154
Socialism, Napoleon on 250
Soda locomotives 154
Soda, nitrate 245
Soldering case *258
Solutions, preparing 106
Sound, experiments in *105, *119
Sound, telegraphing 32
Spark arresters wanted 195
Spectrum, solar, photography 53
Spider, mimicry by 234
Spider's thread, size 102
Spiral, lathe to turn *376
Spring for vehicles *98, *130
Spring lock *178
Spring, suspender *259
Spring, watchcase *66
Springs, tinned 321
St. Sophia 293
Stag beetle, tropical *217
Stains in photo prints 17
Stamps, rubber, making 6
Statues of Bamian *377
Statue of Liberty *100, 272, 288, 320
Steam boilers, cold zone in 369
Steam, condensation of *9
Steam engine, Belt's *93
Steam engine, Dann's *183
Steam engine, Louque's *338
Steam engine, Mennig's *25
Steam engine, Rush's *178
Steam engine, six cylinder *86
Steam for balloons 401
Steam generator *323
Steam gyroscope *335
Steam heater, new *99
Steam jet propulsion 401
Steam tricycle *390
Steamer Etruria 214
Steamer, ocean, hold of 272
Steamer, war, Spanish *359
Steamers at low cost 241
Steamers, German, new *198
Steamers, propulsion of 401
Steamboat, 10 in. draught 360
Steel, compound for 388
Steel forging, a great 83
Steel pipe 337
Steel process, basic 48
Steel, tempering 369
Steel works, new 54
Steering gear, temporary *152
Step, length of 339
Stethoscope, vibrating *248
Stirrup, safety *388
Stone, a sacrificial 58
Stone, saltpetering in 216
Stone, luminous 131
Stop for engine *5
Stop motion, loom *244
Stopper fastener *180
Stoppers for varnish bottle 106
Stove order not invalid 272
Stove, gas, Bisbee's *166
Straw shoes, Chinese 339
Subways, electric, New York 36
Subways, electrical 64
Sugar as anti-incrustator 280
Sugar, iron dissolved by 8
Sugar machinery *404
Sugar making 325
Sulky, saddle *248
Sun, eclipse of, 1886 225
Sun, eclipse, recent 225
Sun images as a measure 261
Suspender spring *258
Swage, saw, Ward's *372
Swindlers, petty 65
Switch, a frogless *306
Switch stand, new *98
Sweeper, boiler, Levi's *18
Sword, electric 274

T

Table, sheep shearing *371
Tadpoles, polarity of 3, 69
Tag, address *132
Tanks, repairing *344
Tanning in China 137
Tanning leather 106
Tanning, new mode 375
Target, revolving *307
Tarsiers, Malayan *295
Taxidermal art 129
Tea drinker's disease 65
Teaching for hands 87
Telegram, father's first 35
Telegraph circuit, ocean 64
Telegraphing sound 32
Telephone, bee in *18
Telephone, Cushman 208
Telephone exhibition 374
Telephone, House's *303, 325
Telephone, long distance *183
Telephone of 1664 81
Telephone patent, Bell 304, 320
Telephone transmitter *404
Telephonic induction 245
Telephoning, long distance 69, 208
Telescope, Lick 85
Tempering steel 369
Terrawerra Lake *57
Tests for water 20
Tetanus, treatment 84
Theater fires 52
Theosophy explained 181
Thermo-electric materials 273
Thermometer, alarm *39
Thunder storms 147
Ties, cross, railway *40
Ties, metallic 291
Tilden trust 128
Timber, good features of 278
Time, fast 23
Time register *388
Tin, aluminum 242
Tinkers and their tricks 72
Tires, wagon, setting *149
Tobacco, smoking and cold 312
Toboggan, improved *243
Tool, combination *211
Top, centrifugal *392
Top, chameleon *239
Top, home-made *137
Top, scientific *230
Torch, magnesium 58
Torpedo, Brennan 280
Torpedo boat *88, 337
Torpedo boats in the gale 48
Torpedo boats, new *387
Torpedo cannon ball 309
Torpedoes, motor for 53
Torpedoes vs. rams 336
Torpedoes 80 years ago *368
Torricelli's principle *265
Tower, Eiffel's proposed 118
Tower, French, proposed 278
Tower, water, fall of *405
Track-laying, car for *274
Track, railway *50
Trade-mark case 166
Trades in France 72
Train, fast 359
Tramway, electric, Hamburg *215
Transmitter, telephone *404
Travelers, hints for 68
Tree, desert, value of *135
Tree, fireproof 394
Tree growth, remarkable 240
Trees, renovating 68
Trees, transplanting 19
Tricycle, steam *390
Tubes, metal, machine for *374
Tunnel, new, Berlin *310
Tunnel, Rocky Mountain 325
Tunnel, Severn, opening 406
Tunnel, water, Chicago 357
Tunneling by freezing *259
Turtle, snapping *370
Turtles, longevity of 311
Twine 256
Type writer, cheap *246
Type writer, first *383
Type writer, Hall *24
Tyrotoxicon 112

U

Umbrella support *324
Umbrellas, care of 182
United States, progress 20
University, Cornell, progress 384
Unrest, causes of 184

V

Vacuum, capillary *281
Vacuum, capillary *297
Valve, check, Glace's *178
Valve, slide, to set 37
Valves, piston, locomotive 340
Varnish for metals 385
Varnish, photo 216
Vehicle, Dinsmore's *387
Ventilation of ships 167
Ventilation by flues 34
Venezuela, phenomenon in 389
Verbena oil, source 104
Vertigo of the kojak 360
Vessels, carriage of *275
Vessels, centerboard for *275
Vessels, naval *386
Vinegar, sharpness of 241
Visions, nocturnal, causes of 184
Volcanic ducts 309
Volcanic ejections 178
Volcanic eruptions *57
Vulcanizer, Cawl's *115

W

Wages, century's rise 240
Wagon tires, setting *149
Wakley, Jas. G 279
Wall, party, law as to 297
Walls, greatest of 353
War ship design, prize 226
War ships, protection 212
War steamer Tonnant *291
War steamer, Spanish *359
Wardrobe attachment *196
Washboards 370
Washing machine *274
Watch pendant key *386
Watchcase spring, Frazure's *66
Watches, demagnetizing *207
Water colors, effect of light 265
Water, compression 258
Water, damming 406
Water, filtration of 354, 389
Water gas, method 256
Water gauge *371
Water, heating 112
Water, heating rapidly *279, 369
Water in steam pipes 387
Water-level indicator *35
Water mains, leaks in 276
Water mains, pipes for 330
Water motors, efficiency of 17, 49
Water pipe melted by lightning 371
Water pipes, arrangement 257
Water, polluted, dangers 233
Water power in cities 261
Water supply, New York 144, 192, *326
Water tests 20
Water tests, simple 325
Water tower, fall of *405
Water tower, Texan *264
Water works, Paris *163
Water works, system of *276
Water proofing cloth 247
Wedge paradox *57
Welding by electricity 208
Well, artesian, hot water 52
Well, artesian, remarkable 168
Well, hot, artesian 115
Wells, artesian, Denver 147
Wells, deep, how made *111
Whale, collision with *375
Whale hunting 65
Whale, right 117
Whales, flukes of 234
Wheel boring machine *374
Wheel hub, new *388
Wheel, measuring *66
Wheat crease, dirt in 133
Wheat, exports of 66
Whiffletree, improved *50
Wilmarth, Seth 339
Wind pressure 133
Windmill, Wood's *50
Window blind *114
Window sash opener *114
Wire painting machine *50
Wires, electric, Brooklyn 384
Wires in cities 192
Wires, insulating *275
Woman, engineer 389
Women, scientific 104, 244
Wood, spontaneous combustion 385
Wood working machine *5
Woolen fabrics, to clean 209
Woolen manufacturers in Japan 257
Wood, jarrah 293
Work and habits 336
Work, out of 160
Wreck of the Oregon 64
Wrench, Dean's *162
Wrench, pipe, Fatkin *84
Wrench, Wood's *104
Writing machine, first *383
Writing tablet *118

Y

Yacht, Eureka, propulsion *47
Yacht, Galatea *181
Yachts, steam, race of 65
Yarns, examination of 118
Years, one hundred 323
Yucca, remarkable *135

Z

Zarabatana, the *121

Joshua Rose's Great Treatise on Steam Engines.

JUST PUBLISHED.

Modern Steam Engines.

An elementary treatise upon the Steam Engine, written in plain language, for use in the workshop as well as in the drawing office: giving full explanations of the construction ot modern Steam Engines, including diagrams showing their actual operation; together with complete, but simple, explanations of the operations of various kinds of valves, valve motions, link motions, etc., thereby enabling the ordinary engineer to clearly understand the principles involved in their construction and use, and to plot out their movements upon the drawing board. By Joshua Rose, M.E. Illustrated by 422 engravings. In one volume, quarto, 320 pages. *Price* $6.00, *free of postage to any address in the world.*

☞ *An illustrated circular, 8 pages, 4to, giving the contents of this remarkable book, will be sent free to any one who will furnish his address.*

BY THE SAME AUTHOR.

Mechanical Drawing Self-Taught. Comprising Instructions in the Selection and Preparation of Drawing Instruments, Elementary Instruction in Practical Mechanical Drawing: together with Examples in Simple Geometry and Elementary Mechanism, including Screw Threads, Gear Wheels, Mechanical Motions, Engines and Boilers. By Joshua Rose, M.E. Illustrated by 330 engravings. 8vo, cloth, ... $4.00

The Complete Practical Machinist: Embracing Lathe Work, Vise-Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, Tool Grinding, Marking out Work, etc. By Joshua Rose. M.E. Illustrated by 356 engravings. Thirteenth edition, thoroughly revised and in great part rewritten. 12mo, 439 pages, ... $2.50

The Slide Valve Practically Explained. Embracing Simple and Complete Practical Demonstrations of the Operation of each element in a Slide Valve Movement. By Joshua Rose, M.E. Illustrated by 35 engravings. 12mo, cloth, ... $1.00

☞ *The above or any of our Books sent by mail, free of Postage, at the publication prices, to any address in the world.*

☞ *Our Catalogue of Practical and Scientific Books 96 pages, 8vo, and our Catalogue of Books on Steam and the Steam Engine, Mechanics, Machinery, and Dynamical Engineering, and other Catalogues, the whole covering every branch of Science applied to the Arts, sent free and free of Postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut Street, Philadelphia, Pa.,

The Techno-Chemical Receipt Book:

NOW READY.

The Techno-Chemical Receipt Book.

Containing Several Thousand Receipts, covering the Latest, most Important, and most Useful Discoveries in Chemical Technology, and their Practical Application in the Arts and Industries. Edited chiefly from the German of Drs. Winckler, Elsner, Heintze, Mierzinski, Jacobsen, Koller, and Heinzerling, with additions by William T. Brannt, Graduate of the Royal Agricultural College of Eldena, Prussia, and William H. Wahl, Ph. D. (Heid.), Secretary of the Franklin Institute, Philadelphia, author of "Galvanoplastic Manipulations." Illustrated by 78 engravings, in one volume, over 500 pages, 12mo, closely printed, containing an immense amount and a great variety of matter. Elegantly bound in scarlet cloth, gilt. Price $2, *free of postage to any address in the world.*

☞ *A circular of 32 pages, showing the full Table of Contents of this important Book, sent by mail, free of postage to any one in any part of the World who will furnish his address.*

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.

ELECTRICAL. Edward P. Thompson, Solicitor of Electrical Patents, 3 Beekman Street. Write for testimonials and instructions.

FOREIGN PATENTS.

Their Cost Reduced.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law, which went into force on Jan. 1st. 1885, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well protected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India Australia, and the other British Colonies.

An experience of FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

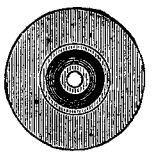
A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each and othe information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

Address, **MUNN & CO.,**
Publishers and Patent Solicitors,
361 Broadway, New York.

BRANCH OFFICES: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

PILES, knife, purge, salve or suppository. Liver, kidney and all bowel troubles—especially constipation—cured like magic. Sufferers will learn of a simple remedy free, by addressing, J. H. REEVES, 78 Nassau St., N. Y. Instant relief. Final cure and never returns. No indelicacy. Neither



Emery Wheel.

SOLID VULCANITE EMERY WHEELS.

All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard **BELTING, PACKING, HOSE,** and **WHEELS:** Address for *new* circular,

NEW YORK BELTING & PACKING CO.,
Warehouse: 15 Park Row, opp. Astor House, New York.
Branches: 308 Chestnut St., Phila., 167 Lake St., Chicago, 52 Summer St., Boston.
JOHN H. CHEEVER, Treas. J. D. CHEEVER, Dep'y Treas.

The Caligraph.

LIFE IS TOO SHORT TO WRITE OLD THE WAY

Address: The American Writing Machine Co., Hartford, Conn.; New York Office, 237 Broadway,

ARTESIAN

Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue.

Pierce Well Excavator Co. New York.

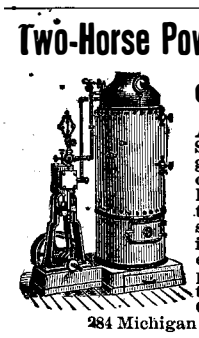
AMERICAN WOODS.

20 Specimens. Polished. In case. $2. The Havens Cabinet. 212 Pine St., Jersey City, N. J.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29. ST. NEW YORK CITY

$10.00 to $50.00 per night. A light and profitable business. **Magic Lanterns and Views** of popular subjects. Catalogues on application. Part 1 Optical, 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc. **L. MANASSE, 88 Madison Street, Chicago, Ill.**

Two-Horse Power Engine. $150.



WITH STEEL BOILER.

Cheap, Reliable, Safe.

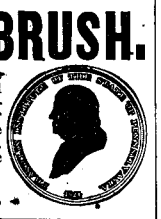
Automatic Boiler Feed. Automatic Pop Safety Valve Steel Boiler, Cost of running guaranteed not to exceed one and one-half cents per horse power per hour. Less than half that of any kerosene engine of equal efficiency. Nothing equal to it ever before offered for the price. Send for free descriptive circular.

CHAS. P. WILLARD & CO.
284 Michigan Street, Chicago, Ill.

AIR BRUSH.

Legitimate artists' and draughtsman's tool. Franklin Institute Silver Medal, 1885. Economizes time. Use in black and white, and water colors. Source of elegant and remunerative employment in the arts.

AIR BRUSH MFG. CO.,
67 Nassau St., Rockford, Ill.



MALLEABLE

AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS.
FINE TINNING, JAPANNING AND FINISHING.
THOMAS DEVLIN & CO.'S LEHIGH AVE. & AMERICAN ST. PHILA.

FREE TO F.A.M. Fine Colored Engraving of the *interior* of the Ancient Lodge Room in which the first lodge in N. America was held. Also large illustrated Catalogue of Masonic books and goods with bottom prices. Also offer of first-class business. ☞ Beware of spurious books. REDDING & CO., Masonic Publishers and Manufacturers, 731 Broadway, New York.

INVENTIONS (good) thoroughly worked in Europe by enterprising London Merchant (now in N. Y.). Branches in Manchester, Liverpool, etc. Address "Z," P. O. Box 773, New York.

TRANSMISSION OF STEAM.—A LECture by Chas. E. Emery, delivered in the Sibley College course.—The properties of steam which make it well adapted for a transmission to a distance. The methods adopted to maintain pressure and provide for condensation. The nature of the mechanical devices necessary in a successful street system of steam pipes, with methods of insulation, of supporting and securing the pipes, of overcoming street obstructions, and of making service connections, methods of measurement; and a statement of precautions necessary in operating long steam pipes, of the cause and prevention of water rams, of the nature of the repairs required, with general remarks upon the whole subject. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **543.** Price 10 cents. To be had at this office and from all newsdealers.

WANTED TO PURCHASE—A Grain Dryer. Manufacturers will please enclose circulars to **W., Box 2045, New Orleans, La.**

E·P P S'S

GRATEFUL—COMFORTING.

COCOA

OTTO GAS ENGINE.

GUARANTEED TO CONSUME 25 to 75 PER CENT. LESS GAS THAN ANY OTHER GAS ENGINE Per BRAKE-HORSEPOWER
SCHLEICHER, SCHUMM & CO., PHILADELPHIA and CHICAGO.

ICE & REFRIGERATING

Machines. York Patent. **YORK MFG. CO., York, Pa.**

Moss Engraving Co. 535 Pearl St. New York
cor Elm St
Our Specialty: Fine Illustrated Catalogues
By Our New Moss-Type Process.
Send Green Stamp for Moss Type Specimens.

Mineral Lands Prospected. Artesian Wells Bored. Superior Stationary Engines, specially adapted to Electric Light purposes. Built by PA. DIAMOND DRILL CO., Birdsboro, Pa.

SPECIAL MACHINERY

For Grinding and Polishing

Manufactured by The Somersworth Machine Co.,
E. R. WARE, Agt.,
154 Lake Street, CHICAGO.
Write for Circulars.

A BIG OFFER. To introduce them, we will **Give Away,** 1,000 Self-Operating Washing Machines. If you want one send us your name, P. O. and express office at once. **The National Co., 23 Dey St., N. Y.**

ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Hearfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **1.** The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

CALDWELL'S SPIRAL STEEL CONVEYOR

CALDWELL'S SPIRAL STEEL CONVEYOR,
131-133 West Washington St., Chicago, Ill.

The New Catalogue of Valuable Papers

contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, N Y.

HYDRAULIC FLANGED HEADS,

OF IRON OR STEEL, FOR BOILER AND TANK MAKERS.

Unequaled for Strength and Uniformity.

THE DICKSON MANUFACTURING CO.
SCRANTON, PA.
96 Lake Street, Chicago. 57 Oliver Street, Boston. 112 Liberty Street, New York.

VALUABLE BOOKS.

Machinist, the Complete Practical.—By Joshua Rose. Embracing lathe work, vise-work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, etc. Illustrated by 356 engravings. Thirteenth edition, thoroughly revised and in great part rewritten. In one volume, 12mo, 439 pages, ... $2.50

Engineer's Handy Book.—By Stephen Roper. The most comprehensive and best illustrated book ever published in this country on the steam engine; stationary, locomotive and marine, and the steam engine indicator. It contains nearly 300 main subjects; 1,316 paragraphs, 876 questions and answers, 52 suggestions and instructions, 105 rules, formulæ, and examples, 149 tables, 195 illustrations, 31 indicator diagrams, and 167 technical terms; over 3,000 different subjects, with the questions most likely to be asked when under examination, before being commissioned as an engineer in the U. S. Navy or Revenue Service, or licensed as an Engineer in the Mercantile Marine Service, . $3.50

Engineer's Pocket-Book.—By Charles H. Haswell, civil, marine, and mechanical engineer. Giving tables, rules, and formulas pertaining to mechanics, mathematics, and physics, architecture, masonry, steam vessels, mills, limes, mortars, cements, etc. New edition, entirely rewritten, containing much new matter, as masonry, canals, dams, building materials, floor beams, optics, logarithms, etc., with 226 additional pages, making 922 pages. Forty-ninth edition, pocket-book form, leather, ... $4.00

Locomotive.—Cathechism of the locomotive, by W. N. Forney, mechanical engineer, with tables, 19 plates, and 227 wood engravings, crown 8vo, cloth, . $2.50

Steam Engineer's Guide in the design, construction, and management of American stationary, portable and steam fire engines, steam pumps, boilers, injectors, governors, indicators, pistons, and rings, safety valves, and steam gauges. For the use of engineers, firemen and steam users. By Emory Edwards. Illustrated by 119 engravings. 420 pages, 12mo, . $2.50

Steam Engine.—A catechism of the steam engine in its various applications in the arts, to which is now added a chapter on Air and Gas Engines, and another devoted to useful rules, tables and memoranda. By John Bourne, C.E. New edition, much enlarged, and mostly rewritten. Illustrated by 212 woodcuts, for the most part new in this edition, 12mo, cloth, . $3.00

The above books sent by mail, postpaid, on receipt of the price.

☞ Send for our complete Catalogue of books, free to any address.

MUNN & CO., Publishers of "Scientific American."
361 Broadway, New York.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116.** Price 10 cents. To be had at this office and of all newsdealers.

BALL UNIPOLAR System of Electric Lighting is cheapest and best for Arc or Incandescent. For information, guarantees, and estimates, address
NOVELTY ELECTRIC CO.,
5th & Locust Sts., Philadelphia.

TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.

UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,310 tons of steel gun-forgings, of which about 328 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch	.....	3¼ tons.
8 "	.....	5 "
10 "	.....	9½ "
10½ "	.....	9½ "
12 "	.....	12½ "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4½ feet by 6 inches thick.
There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.

First. Gun Forgings.

Second. Armor-plate.

And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY,
Secretary of the Navy.

NOTICE.

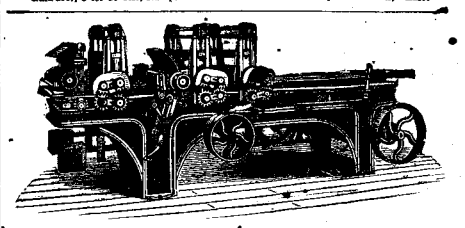
NAVY DEPARTMENT,
WASHINGTON, *November* 6, 1886.

The time fixed by the foregoing advertisement, dated August 21, 1886, for receiving proposals for steel gun-forgings and armor-plates, viz.: December 10, 1886, is extended to 12 o'clock noon, March 15, 1887, at which hour the opening of the bids will take place.

WILLIAM C. WHITNEY,
Secretary of the Navy.

Barnes' Foot-Power Machinery. Complete outfits for Actual Worksnop Business. Read what a customer says: "Considering its capacity and the accurateness of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day and at night feel as little tired as if I had been walking around." Descriptive Catalogue and Price List Free. W. F. & JOHN BARNES Co. Address 1999 Main St., Rockford, Ill.

DYKE'S BEARD ELIXIR Forces heavy Mustache, Whiskers, or hair on bald heads in 20 to 30 days. Extra Strength. No other remedy. 2 or 3 Pkgs. does the work. We will prove it or forfeit $100.00. Price per Pkg. sealed and postpaid 25c., 5 for 50 cts., stamps or silver. SMITH MFG. CO., PALATINE, ILLS.



WITHERBY, RUGG & RICHARDSON, Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Ball & Co., Worcester, Mass. Send for Catalogue.

THE CHEAPEST AND BEST
PHOTO ENGRAVING CO.
67 PARK PLACE, NEW YORK
ENGRAVING FOR ALL ILLUSTRATIVE AND ADVERTISING PURPOSES

CURE FOR THE DEAF

PECK'S PATENT IMPROVED CUSHIONED EAR DRUMS Perfectly Restore the Hearing, and perform the work of the natural drum. Invisible, comfortable and always in position. All conversation and even whispers heard distinctly. Send for illustrated book with testimonials, FREE. Address or call on F. HISCOX, 853 Broadway, New York. Mention this paper.

DEAFNESS Its causes, and a new and successful **CURE** at your own home, by one who was deaf twenty-eight years. Treated by most of the noted specialists without benefit. *Cured himself* in three months, and since then hundreds of others. Full particulars sent on application.

T. S. PAGE, No. 41 West 31st St., New York City.

CONSUMPTION CURED

AND LUNG AFFECTIONS

Home Treatment. A late discovery by a celebrated German Physician. Is a POSITIVE remedy in Every Stage. Treatise with directions sent FREE to any sufferer.

Dr. W. F. G. Noetling & Co., Box 450 East Hampton, Conn.

ELECTRIC BELT, Suspensory etc., for Kidneys, Pain, Nervous and Weak. Fortune for Agents. Book free. UNITED ELECTRIC CO., Cleveland, O.

© 1886 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

FOR SALE.

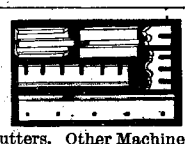
State, County, and Territorial Rights in The Family Emergency Medicine Chest; or will be given to reliable firms on Royalty. Canada for sale in a lump. See cut and description in SCIENTIFIC AMERICAN, Nov. 20, 1886. Address **Dr. T. J. HUTTON,**
College of Physicians and Surgeons,
CHICAGO, ILL.

AN OUTLINE HISTORY OF THE LOCOmotive Engine in England.—A valuable and interesting paper by Theo. West, giving a chronological account of the various inventors who have worked at the problem of steam traction upon railways, and a brief description of the motors devised by them. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **541.** Price 10 cents. To be had at this office and from all newsdealers.

PATENT
JACKET KETTLES,
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
HAND, BURR & CO.,
614 and 616 Market St., Philadelphia, Pa.

COLD AS A CAUSE OF DEAFNESS.—A short but comprehensive paper by Dr. Theodore Griffin, answering the two important questions: How can the injurious effects of cold upon the ears be prevented? and secondly, How can they be cured after they have been developed? Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **265.** Price 10 cents. To be had at this office and from all newsdealers.

Established 1837.
Machine Knives,
L. & I. J. WHITE,
BUFFALO, N. Y.



Planing, Moulding, Shingle and Stave, Hoop and Veneer. Plated Stock and Blanks for Moulding Cutters. Other Machine Cutters to Pattern. Moulding Cutters can be ordered by number from Universal Moulding Book.

PHOSPHATE MINES OF CANADA.—By Beau Mont.—An interesting paper describing the various mines of apatite or "phosphate" of Canada.—Geography and geology of the phosphate districts. How phosphate has been formed. The various mines and their products. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **537.** Price 10 cents. To be had at this office and from all newsdealers.

Transmission of Power.
Suspension Bridges,
Tramways,
and other applications of
WIRE ROPE
Trenton Iron Co.
WORKS and OFFICE, TRENTON, N. J.
New York Office—COOPER, HEWITT & Co., 17 Burling Slip. Philadelphia Office—21 North Fourth Street. Chicago Office—146 Lake Street.

ASBESTOS Felt Works, 101 Maiden Lane, N. Y. Asbestos and Hair Felt Boiler and Pipe Coverings. Asbestos materials of all kinds manufactured and applied. Estimates given.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **59.** Price 10 cents. To be had at this office and of all newsdealers.

Mention this paper.

INTERNATIONAL INSTITUTE FOR
Liquefied Carbonic Gas.
O. BRUNNER, 857 Broadway, New York.

HOW TO GRAFT.—A VALUABLE PAper, giving complete directions for making various kinds of grafts in fruit trees.—Cleft grafting, slip grafting, bear's mouth grafting, wired grafting, side grafting, whip grafting, saddle grafting, tongue grafting, split grafting, crown grafting. Grafting-wax. Waxed cloth. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **540.** Price 10 cents. To be had at this office and from all newsdealers.

WM. A. HARRIS,
Providence, R. I. (Park St.) Six minutes' walk West from station.
Original and Only Builder of the
HARRIS-CORLISS ENGINE
With Harris' Pat. Improvements, from 10 to 1,000 H. P.
Send for copy Engineer's and Steam User's Manual. By J. W. Hill, M.E. Price $1.25.
MENTION THIS PAPER.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

H. W. JOHNS'
ASBESTOS
CORDED SHEATHING.
A Fire-Proof Non-Conducting Covering for
HEATER AND STEAM PIPES
IN CELLARS, ETC.

H. W. JOHNS'
ASBESTOS
STOVE & FURNACE CEMENT.
A fire and acid proof material for cementing and repairing joints in Heaters, Furnaces, Stoves, Ranges, etc.
PREPARED READY FOR USE.

H. W. JOHNS MANUFACTURING COMPANY,
87 MAIDEN LANE, NEW YORK.
—CHICAGO.—o—PHILADELPHIA.—o—LONDON.—
SOLE MANUFACTURERS OF
H. W. JOHNS' ASBESTOS LIQUID PAINTS, ASBESTOS ROOFING, STEAM PIPE AND BOILER COVERINGS, STEAM PACKING FIRE & WATER PROOF SHEATHING, PLASTIC STOVE-LINING, ETC.
PAMPHLET ON "STEAM-SAVING AND FIRE-PROOF MATERIALS," FREE BY MAIL.

CLARK'S NOISELESS RUBBER WHEELS
No more Splintered Floors.
Different Styles. Catalogue Free.
GEO. P. CLARK,
Box L. Windsor Locks, Ct.

BARREL, KEG,
Hogshead,
AND
STAVE MACHINERY.
Over 50 varieties manufactured by
Truss Hoop Driving. **E. & B. Holmes,**
BUFFALO, N. Y.

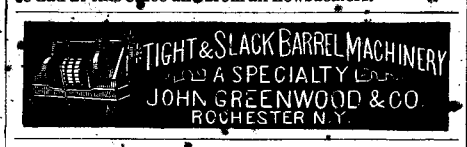
SOLID EMERY WHEELS.—BY T. D. Paret.—Early forms of emery wheels and their defects. Vulcanite wheels. The tanite wheels. Testing of tanite wheels at Stroudsburg. Best working speeds for emery wheels. Bursting of emery wheels. Tests for emery wheels. Comparative merits of American and English emery wheels. With 2 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **538.** Price 10 cents. To be had at this office and from all newsdealers.

Telegraph and Electrical SUPPLIES
Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue **C. E. JONES & BRO. Cincinnati, O.**
It is important to us that you mention this paper.

TUNNEL FOR FOOT PASSENGERS IN Stockholm.—Description of a difficult piece of tunneling, in which the freezing method was applied with success. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **542.** Price 10 cents. To be had at this office and from all newsdealers.

Use the JENKINS STANDARD PACKING in the worst joint you have, and if, after following directions, it is not what we claim, WE WILL REFUND THE MONEY.
Our "Trade Mark" is stamped on every sheet. None genuine unless so stamped. Send for Price List.
JENKINS BROS.,
71 John Street, N. Y. 79 Kilby Street, Boston.
13 So. Fourth Street, Phila.

VELOCITY OF ICE BOATS. A COLLECtion of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of ice boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **214.** Price 10 cents. To be had at this office and from all newsdealers.



FUNGI INDUCING DECAY IN TIMBER. By P. H. Dudley.—The dry rot of timber and the cause of it. List of fungi that aid in the decomposition of wood. Destruction of ties and bridge timbers. Wet rot. Fungi special to each kind of tree. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **538.** Price 10 cents. To be had at this office and from all newsdealers.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

POLARIZED LIGHT. BY GEO. M. Hopkins.—An interesting paper upon one of the most difficult, least generally understood, and most theory-beset branches of the study of light. Illustrated with 15 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **538.** Price 10 cents. To be had at this office and from all newsdealers.

PLAYS Dialogues, Tableaux, Speakers, for School, Club, & Parlor, Best out. Catalogue free. T. S. Denison, Chicago.

STEAM CARRIAGES.—DESCRIPTION of the Rowan steam carriage, which was awarded the gold medal at the Antwerp tramway trials. With 11 engravings, showing the various forms of the carriage and motor, and details of the same. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **541.** Price 10 cents. To be had at this office and from all newsdealers

POINTERS for Users of Steam Pumps.
Van Duzen's Patent Steam Pump
Can Pump { Hot or Cold. / Sandy or Impure / Water or Liquids } Is Efficient.
Has no moving parts, consequently no wear, no repairs, no trouble. Purchasers assume no risks, as we guarantee every Pump. Above comparison with Jet Pumps, Ejectors, etc., made of Iron. Demand this Pump of your dealer and take no cheap substitute. We make Ten Sizes. Prices from $7 to $75. Capacities from 100 to 20,000 gallons per hour. State for what purpose wanted and send for Catalogue of "Pumps."
VAN DUZEN & TIFT, Cincinnati, O.

THE INVENTION OF MACHINES.—A paper by Prof. Hale Shaw, pointing out what is necessary for the foundation of a science of the invention of machines, and showing what steps have already been taken in this direction. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **542.** Price 10 cents. To be had at this office and from all newsdealers.

ELECTRIC **LEATHER BELTING** best and most reliable Belt ever introduced. Made by **C. A. SCHIEREN & CO.** 47 Ferry St., New York; 416 Arch St., Philadelphia; 86 Federal Street, Boston.

ARGENTIC-BROMIDE EMULSIONS.—A paper by H. London on an apparatus for preparing argentic bromide emulsions, and for coating and drying plates. With 15 engravings, illustrative of apparatus and manipulations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **541.** Price 10 cents. To be had at this office and from all newsdealers.

PHONOGRAPHY or Phonetic Short Hand. Works for self-instruction, by Benn Pitman and Jerome B. Howard, for sale by all book-sellers. Catalogue, alphabet and illustrations sent free. Address,
PHONOGRAPHIC INSTITUTE, Cincinnati, O.

RECENT PROGRESS IN CHEMISTRY. By Prof. H. C. Bolton.—Chemical societies, new elements, atomic weights, spectrum analysis, form of matter, affinity and chemical action, electrolytic thermal chemistry, new views of chemical reaction, chemical dynamics, chemical physics, liquefaction of gases, chemical industries, nomenclature, progress in organic chemistry, the aromatic series of compounds, synthesis of organic compounds, physiological and sanitary chemistry, tendency of modern chemistry. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **546.** Price 10 cents. To be had at this office and from all newsdealers.

RUBBER BELTING, PACKING, HOSE,
AND ALL OTHER KINDS OF
RUBBER GOODS,
FOR
MECHANICAL AND MANUFACTURING PURPOSES.
The Largest and Most Extensive Manufacturers in America.
THE GUTTA PERCHA AND RUBBER MFG. CO.,
New York, Chicago, San Francisco, Toronto.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

CAPILLARY TUBES, SPONTANEOUS Motion in.—A paper by C. Decharme upon the application of electricity to the study of the spontaneous ascensional motion of liquids in capillary tubes—the question being studied from a dynamic standpoint. With 10 engravings of apparatus and details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **538.** Price 10 cents. To be had at this office and from all newsdealers.

PULLEYS.
Order from our "Special List."
THE JOHN T. NOYE MFG. CO.,
BUFFALO, N. Y.

GOLD MEDAL, PARIS, 1878.
BAKER'S
Breakfast Cocoa.

Warranted *absolutely pure Cocoa*, from which the excess of Oil has been removed. It has *three times the strength* of Cocoa mixed with Starch, Arrowroot or Sugar, and is therefore far more economical, *costing less than one cent a cup.* It is delicious, nourishing, strengthening, easily digested, and admirably adapted for invalids as well as for persons in health.
Sold by Grocers everywhere.
W. BAKER & CO., Dorchester, Mass.

PROSPECTUS
OF THE
Scientific American
FOR 1887.
The Most Popular Scientific Paper in the World.
Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in the SCIENTIFIC AMERICAN a popular *résumé* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—One extra copy of the SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.00 each; additional copies at same proportionate rate.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO.,
361 Broadway, New York.

THE
Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Address and remit by postal order, express money order, or check,
MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, one year; $9, gold for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

PRINTING INKS.
THE "Scientific American" is printed with CHAS ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., pop. Duane St., N. Y.

© 1886 SCIENTIFIC AMERICAN, INC